Operating instructions
RONTEC-EDWIN 98 / NT
WinShell / WinTools

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APPENDIX

- Switching the X-ray spectrometer (hardware) on and off
- Setting up the measurement conditions
- Installation of EDWIN software (WinShell and WinTools), DDE-Control

Valid from versions: *WinShell* *1.2*
WinTools *3.0 (1.21)*

1. The RONTEC EDWIN program system

1.1. Introduction

EDWIN consists of several separate programs, RONTEC WinShell for measuring X-ray spectra and identifying the elements and RONTEC WinTools for qualitative and quantitative spectrum evaluation. In addition to that there are implemented a spectra viewer (SpcView) and the print program (SpcPrint). The hardware is controlled and adjusted with WinShell. Element windows can be set up to determine element distributions. Archiving spectra, comparing spectra, setting line markers for element identification are only some of the tasks which can be carried out with WinShell. WinTools provides all functions for processing and evaluation of energy-dispersive measured X-ray spectra which were successfully used for many years under the name RONTEC Tools. A wide range of customer experience and requirements obtained from servicing of the spectrometers EDR-288 and the M series was taken into account in the development of the software and is now available under the name of RONTEC WinTools.

RONTEC **WinShell** is intuitive in its operation, and it provides the accustomed functions for users who are experienced with WINDOWS. The spectral determination process permits the standardised measure modes and provides a live presentation of the pulse height spectrum increase during the measuring process. An intelligent line marker permits fast identification of the elements even while the spectrum is being measured. Spectra can be compared with the current measurement.

For ease of operation and to help even inexperienced users to get to know the program quickly, the spectrum evaluation program RONTEC **WinTools** offers three user levels. The automatic function offered as icon [A] enables fully automatic evaluation of the spectrum (*"Easy use"*). It can be flexibly set with the icon [->A], and if required it even permits interactive intervention during the evaluation.

The Windows menus "Utility", "Background", "Quantify" and "Settings" offer a selection of the most important functions in order to define and call up individual steps and tasks of the automatic function (*"WINDOWS use"*). After the icon [M] has been selected, the full range of RONTEC Tools are available in the form of the tried and tested RONTEC menu system (*"Professional use"*).

The working process for the measurement and evaluation of a spectrum consists of two steps. The spectrum is measured and saved in WinShell. In the separate WinTools window, the quantitative evaluation is carried out independently of the measuring process. By pressing a key, the last measurement can be imported into WinTools and immediately evaluated.

Both, SpcView and SpcPrint are helpful tools.

SpcView has a functionality, which is compatible to WinShell. In contrast to WinShell, spectra acquisition is not possible. But two stored spectra are comparable. Operator can call SpcView multiple and can use it for Windows links with .imp-type files.

SpcPrint is dealing with printout of spectra, results and comments. Both, WinShell and WinTools have direct link to SpcPrint via special Icon.

As a supplement to these operating instructions, the "RONTEC Tools operating manual" and the hardware description can also be consulted.

Please also refer to the WINDOWS™ manual!

1.2. Start of the program system

After WINDOWS™ has been started, the programs WinShell (if spectra are to be measured, compared and qualitatively inspected) and WinTools (for quantitative evaluation of measured spectra) must be started. This is done with the file manager (Windows 3.1), with "Start" (Windows 95™ and Windows NT™) or by double clicking the corresponding icons on the desktop or in open folders.

Start of applications in
WINDOWS 95 and WINDOWS NT

Measurement of spectra
Comparison of spectra
Element identification
Element distributions

Qualitative and quantitative processing
and evaluation of measured spectra

In addition to that, the operator can use following three programms after a complete installation of EDWIN:

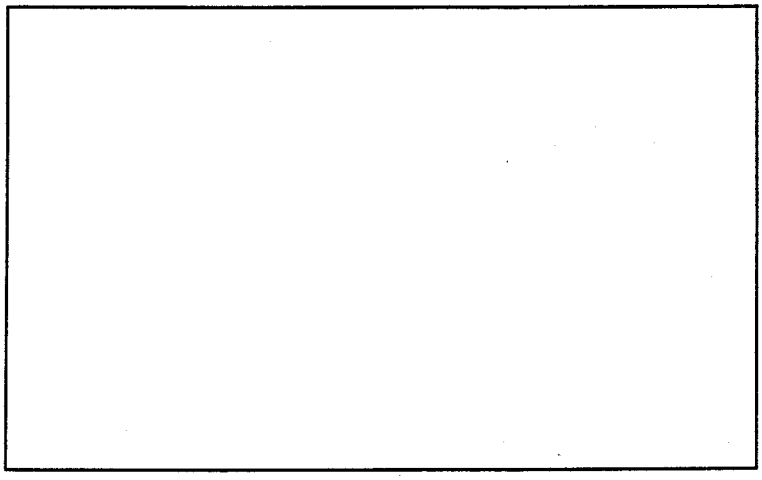
spectra viewer

print layout

uninstallation

As EDWIN can be adapted to the specific configuration of your computer and your software interface, it is possible to note in the space below the specific call-up procedure for the program system on your computer:

To start RONTEC WinShell and RONTEC WinTools:

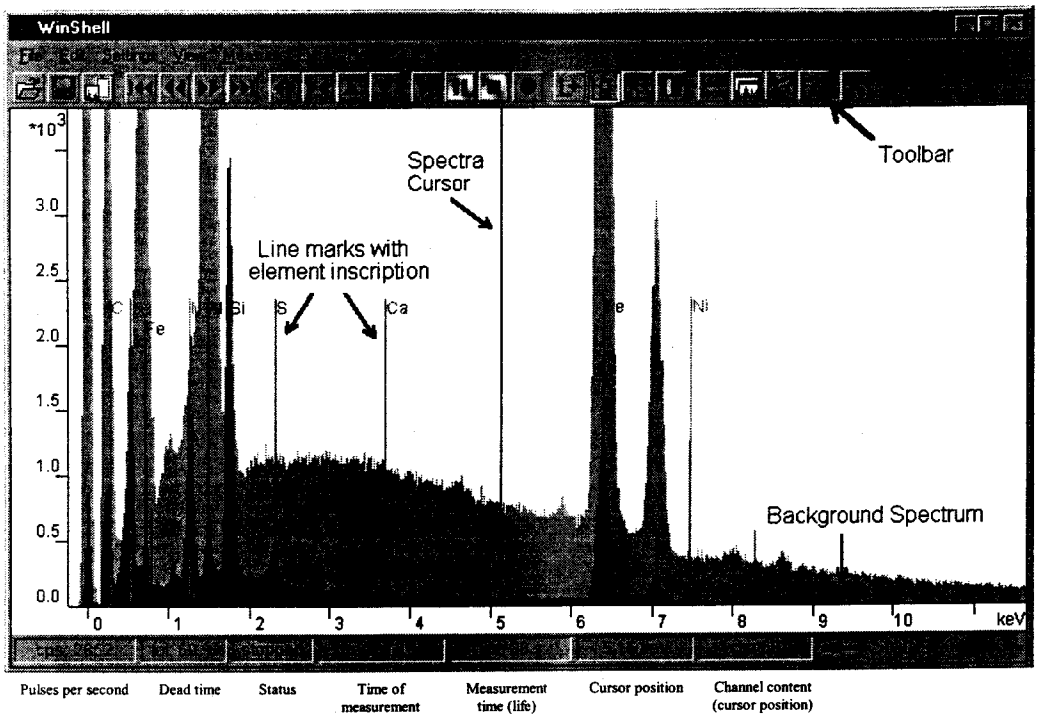


Installation of EDWIN software is discribed in Appendix, last page.

2. Working with WinShell

2.1. Spectrum measurement

The task of measuring spectra and archiving them is carried out with WinShell:



The control of the measuring process is really simple and typically for WINDOWS:

..... Load a spectrum for comparison	..... Save the measured spectrum
..... Place copy into intermediate memory window	.....Print current spectra
..... Spectrum: Scroll to begin	..... Spectrum: Scroll left
..... Spectrum: Scroll right	..... Spectrum: Scroll to end
..... Expand spectrum	..... Compress spectrum
..... Expand Vertical scale	..... Compress Vertical scale
..... Start spectrum measurement	..... Pause
..... Stop spectrum measurement	..... Delete measurement memory
..... Set element line markers / element search to cursor position	..... Line markers <-> peak labelling
..... Alter spectral display	..... Alter spectral colour
..... Startet external WinTools program	..... Setting program window onTop
..... Info for Toolbar Icons	..... General Info
..... Exit program	

Setting Program **on Top** (WinShell is always visible), Toolbar is reduced.

All that is needed is to operate the appropriate icon buttons with the mouse. The spectrum cursor is moved to the required position by clicking with the mouse.

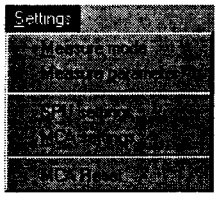
After the measuring process, the spectrum is saved. At this point, each spectrum is allocated a name. After the spectrum has been saved, qualitative and quantitative evaluation can be carried out with WinTools. But the identification of the elements (qualitative analysis) can also be carried out in WinShell with the aid of an intelligent line marker during the measurement process, which saves a great deal of time (see 2.4).

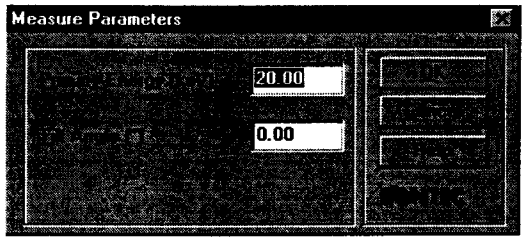
The measuring and saving process can also be controlled with the menus **Measure** and **File** with normal use of the mouse or keyboard. With **Open background**, only one spectrum at a time can be loaded, which can then serve as a comparative spectrum for the current measurement.

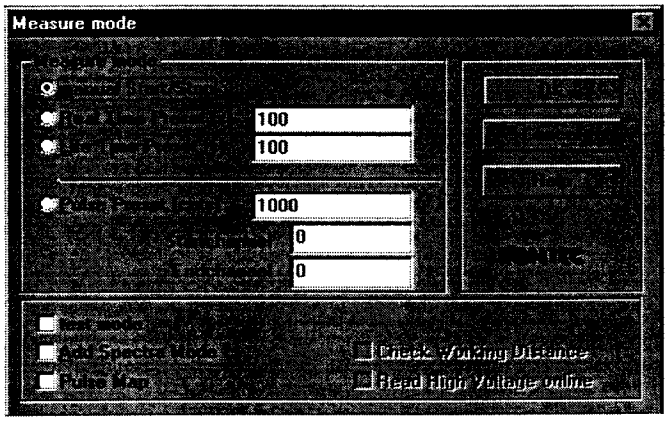
2.2. Measure mode and measure parameters

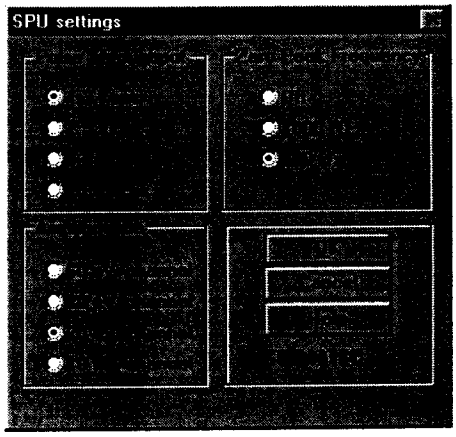
In the **Settings** menu, functions can be called up to adjust the hardware and the measuring regime:

Under **Settings / Measure parameters**, the current primary electron energy (high SEM voltage) and any deviating sample orientation can be entered. The measure mode can be set in the **Measure mode** menu and the hardware can be set under **SPU settings**.





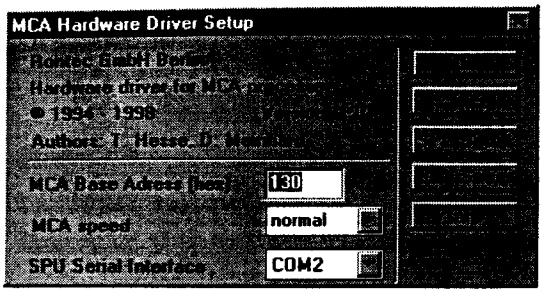




The switches "Check working distance" and "Read high voltage on-line" can be used with the SEM with an optional link.

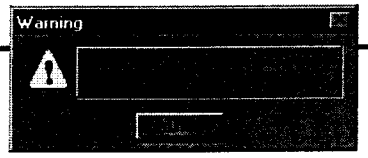
MCA Reset sets the MCA processor back into its basic status. **MCA settings** is used to enter the detector parameters and energy calibration. This function is generally set up only once during the installation of the driver, or used for service purposes. Here, the type, interface and addresses of the signal electronics are entered. The information required is partly dependent on the device.

The functions **SPU Setup** and **EDX Setup** are required to enter the calibration, the detector parameters and the configuration of the pulse electronics (see section 5).



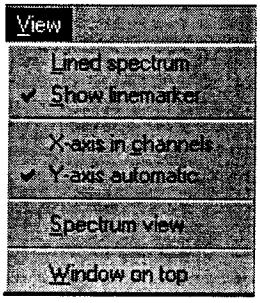
This function is only neded for installation or for service purpose. Operator is able to set interface and adress of signalel processor. He can select speed of data transfer between ISA-bus and MCA processor card. Needed information differ sometimes from device to device and from the used computer. Settings should be given from RÖNTEC service only.

When the pulse density, dependent on the hardware setting, exceeds the allowable limit the dead time increases to well over 50%. At more than 50% dead time WinShell switches over to red dead time and pulse density indication. The pulse density must be reduced or the SPU changed to a different mode (see annex, setting the measuring conditions).
If the admissible dead time is significantly exceeded an error window is displayed. A warning must be confirmed when such a spectrum is saved.



2.3. Display Options

The view options can be set both individually in the **View** menu and all together in the **View / Spectrum view** dialog.

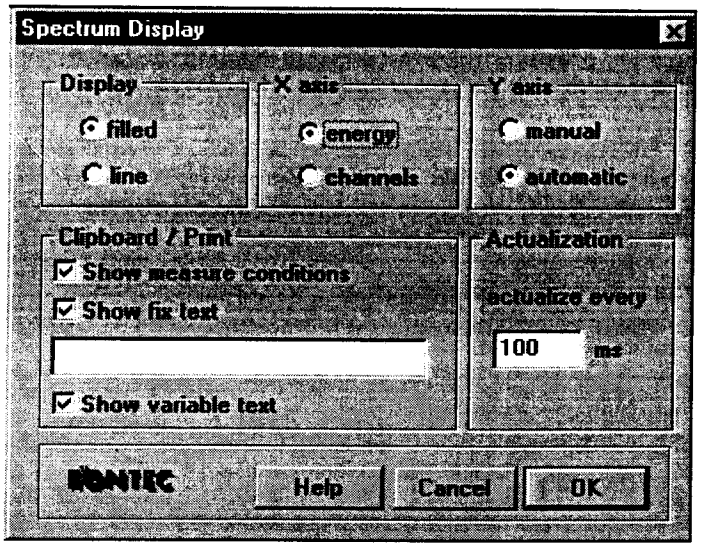


Lined Spectra can be used to switch the presentation of spectra between line presentation and presentation as filled-in bars.

Show linemarker can be used to determine whether or not the element line markers set should be displayed.

X-axis in channels switches the X axis between the energy dimension (in keV) and the channel dimension.

The Y axis can be scaled both manually and automatically **(Y-axis automatic)**. The advantage of automatic scaling is that the improvement of the signal/noise ratio can be observed very well as the measure time increases. Automatic scaling is also useful if the measuring is done "in the background" and the WinShell window is constantly on top of all other windows **(Window on Top)**



Options for spectra display, handling during transfer to clipboard or for printout and cycle time for spectra updating ar given.

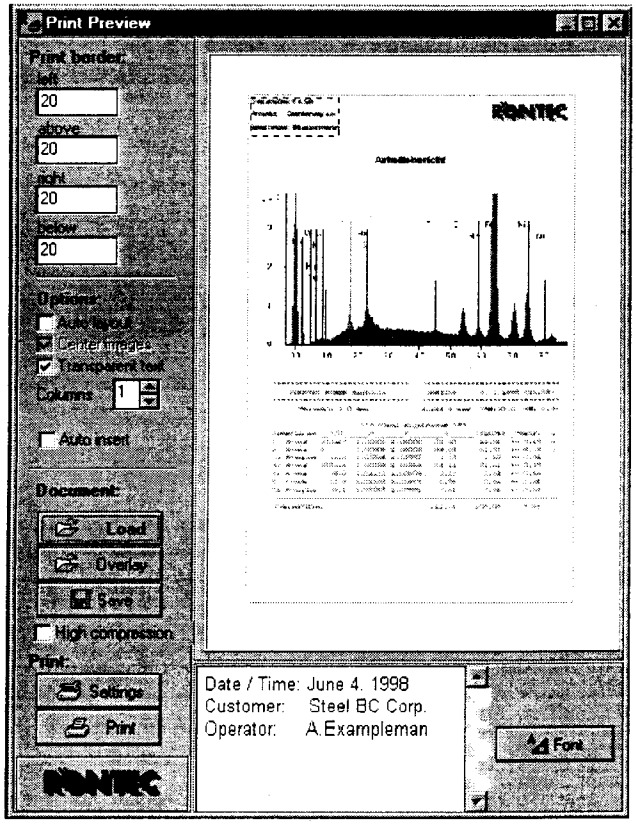
Actualization is the time delay in ms between two spectra transfers from hard-ware. The time is adjustable between 100ms und 5000ms.

During transfer between spectra window to clipboard or print layout, several parts are implementable:

1. current measure conditions (excitation energy, acquisition time and puls density),
2. fix comment for every spectra grafic and
3. variable comment, which needs an input for every transfer.

Operator can mix all parts. If there exists a file named COMMENT.TXT in directory of program spcprint.exe (standard in \EDWIN\WINSHELL\...), this file will inserted into print layout automatically as editable text (e.g. for company head or inscription examle for further editing).

2.4. Spektren-Druck

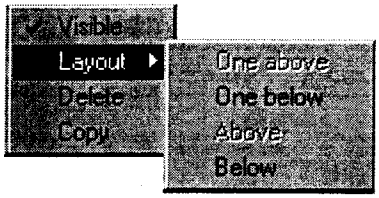


EDWIN prints spectra and results via WYSIWYG - one page printer preview with entire needed information.

Parts of preview are images, results, comments, inscribtions and an possible overlay. Results or images can be loaded with files (*.bmp resp. *.txt) or with clipboard. Complete reports and overlays are loadable with report files (*.rpt). Two steps of data compression are possible used to store reports. Preselected is high speed storage of report files. Selecting 'high compression', the file dimension will be reduced by factor 2. Of course, this way is more time consuming. If there are implemented a lot of images and large images, 'high compression' is recommended.

For placing of parts at the page several ways are implemented. All parts (except the overlay) can be placed to all positions somwhere. Click at right down position to images, and you will change the size. The operator has the choice for fonds, size and color of text, like common in Windows. He can edit all comments and taken over results with integrated Editor. All changes are visible at page preview. With '**Auto layout**' activ, the printer layout places all parts

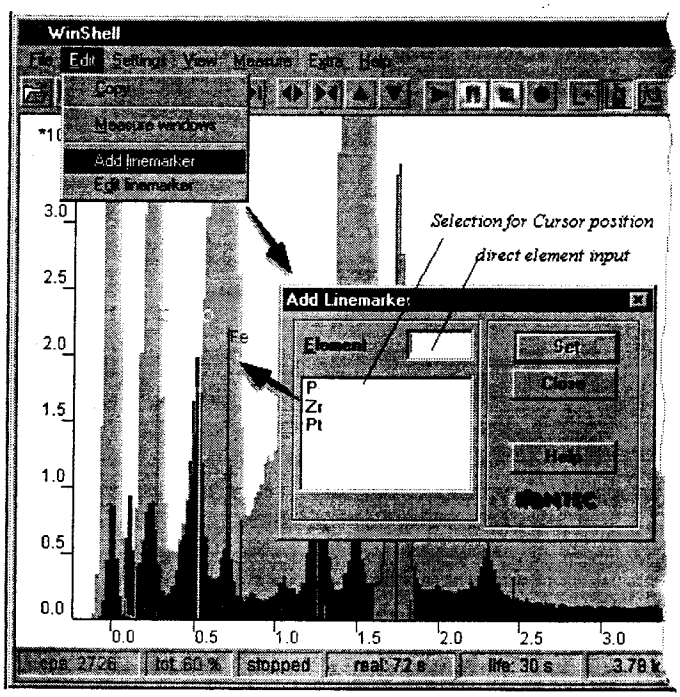
automaticaly. Operator has to choose the number of columns.



Operator can select special functions via popup menu (faded in after pushing right mouse key at selected part). A selected part is visible or not (and in this case not printed), operator can change layout, which part is displayed below and which above. So he can inscribe images addtional. He can copy parts into clipboard or can delete them. Is there any image or text in clipboard, only a right mouse key click at free space is needed to get via **'Insert'** - menu the content of clipboard at selected position. A double click of left mouse key inserts a new text label via built in editor.

It is convenient to activate the switch **'Auto insert'** for a lot of tasks. In this case, SpcPrint watches for changes in clipboard and updates of the file 'result.txt' of WinTools and the new parts are once included at the printer preview. The result will be updated, the spectrum in clipboard will be inserted additionally.

2.5. Identification of elements



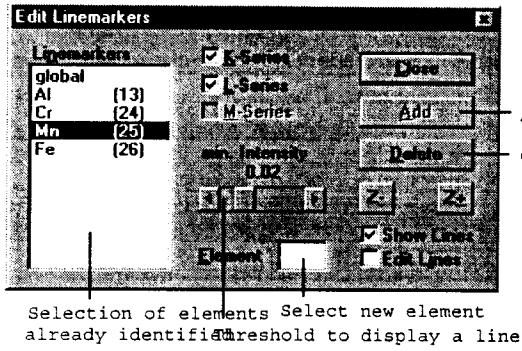
For qualitative analysis (identification of elements), the functions **Add linemarker** and **Edit linemarker** in the menu **Edit** are significant. **Add linemarker** can also be called up directly via the corresponding icons.

Elements can be set and deleted again. The energy positions for the expected lines are immediately displayed as line markers for each element. In accordance with the previously selected current position of the spectrum cursor, WinShell offers all elements which can generate characteristic lines in the selected position. The relative height of the line markers of a line series in relation to each other suggests approximately the proportional pulse rate which must be anticipated.

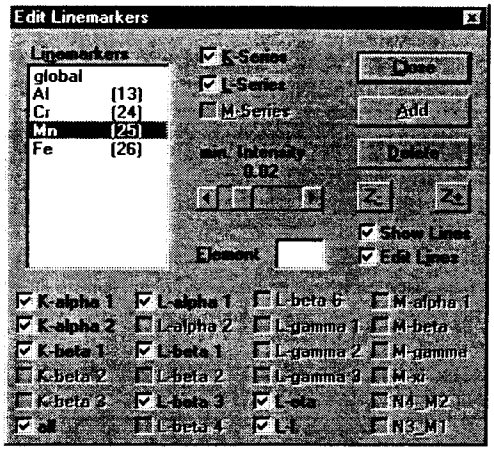
Operator can activates the icon function **[L+]** via left key mouse ***double click*** at spectrum display region.

By contrast with WinTools, WinShell has an integrated "intelligent" line marker. In addition to the exact emission rates of the X-ray lines (atom database rtatom.adl), it also takes into account the primary electron energy and its effect on the relative emission rates of the lines of a series in relation to each other. Especially in critical excitation situations (primary electron energy only slightly greater than the critical excitation energy of the line series under consideration), unusual line distributions can occur which could lead to wrong decisions if the line marker only shows fixed relative intensities.

On the basis of the line positions, their heights and the peak forms (for adjacent lines which are not resolved by the spectrometer), it can be decided relatively well which elements are present in the sample.



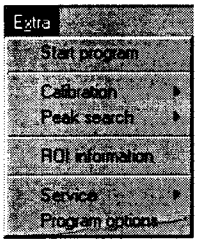
With **Edit linemarker** elements can be set and deleted and the display of line markers can be adjusted very flexibly. A control enables a threshold to be set. This threshold is used to define from which relative intensity stored in the atom data a line marker should be set. This setting can be carried out globally for all line markers or just for selected elements.



With the switch **Edit Lines**, each individual line contributing to the complete series can be displayed. It becomes clear which lines are emitted or are taken into account in the atom database. The line markers can now be switched on or off individually.

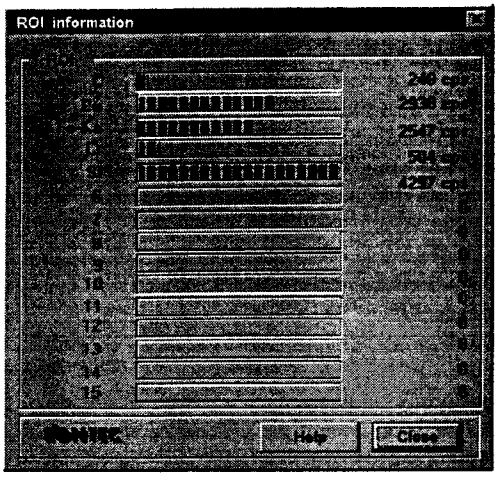
Element identification with line markers is stored when the spectra are saved in the spectrum file. When the spectrum is read in again, the associated identification also appears. With the appropriate switch setting in WinTools, a very effective automatic quantitative spectrum evaluation can be carried out which takes into account the elements defined in WinShell

2.6. Extra



This menu includes a lot of special functions:

1. Operator can start external program (**Start program**; example: WinTools)
2. Operator can recalibrate with spectrum (after basic calibration aftter installation). Next spectra acquisition takes over these new calibration data (**Calibration**). For XFlash detector there is offered the possibility of automatic recalibration for current resolution using zero peak before every spectra storing.
3. Operator can start automatic **Peak search**, which searches all peaks of foreground or background spectrum. Function suggest all possible elements for every peak . Suggested elements are presented in a window named 'Add Linienmarker'. Pushing the button 'Close', the spectrum cursor will jump to the next found peak. Pushing the button 'Cancel' the peak search will terminate.



4. **ROI information** opens a window with count rates of current data acquisition. Operator can set all element windows via **Edit / Measure windows**. If the data acquisition is stoped, sum af channel contents setted measure windows are displayed.
5. **Service** is only for service people.
6. With **Program options** customer or service are able to combine customer# with special PIN to give freee special options of WinShell program (see APPENDIX, Installation of EDWIN software).

2.7. Saving spectra

The spectra are saved and loaded by the normal WINDOWS method, just like other files. The extension of the RONTEC spectrum format is **.imp**. Within the spectrum file, both the spectrum itself and all the identifying elements line markers, are saved.

2.8. Comparing spectra

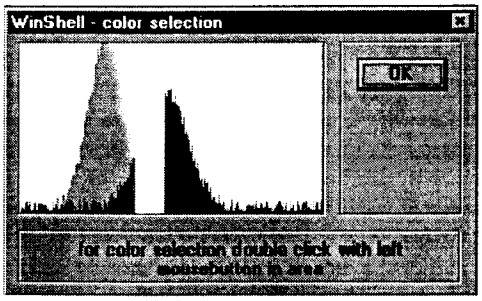
Only one spectrum at a time can be loaded for comparison. A spectrum that has already been measured or a spectrum saved as reference can be overlaid in the background with the current measurement.
If a spectrum is read in for comparison, the line markers set when the spectrum was saved are also displayed and added to the current line markers.

2.9. Display mode for element marking

This function can be used to determine whether, in addition to the element labelling at the respective peak positions, the line markers of the complete X-ray series should be displayed and overlaid over the spectrum.

For reliable element identification, it is advisable to work with line markers. For recording results (display of the spectrum), it is often sufficient to label the peaks with the elements.

2.10. Display mode for spectrum presentation



The spectrum can be presented in different ways (first icon). Suitable colours can be selected (second icon).

For this purpose it is necessary to left-double-click on the desired element of the spectrum window in the colour selection dialog, whereupon the standard WINDOWS dialog for selecting the desired colour opens.

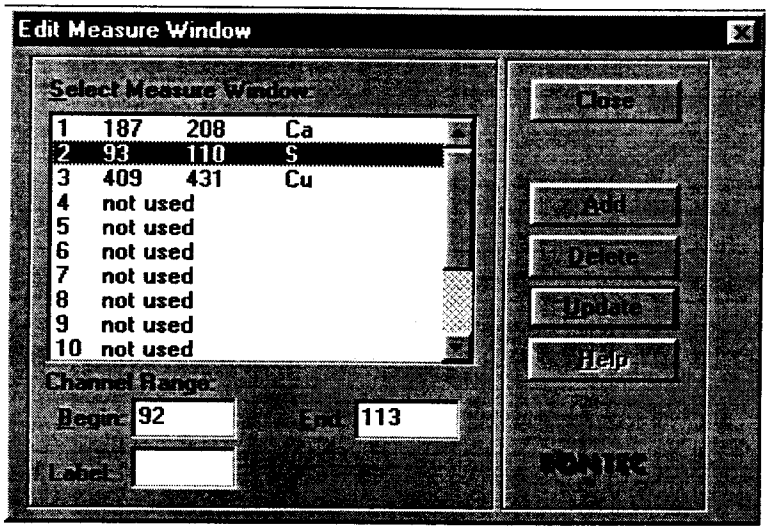
2.11. Placing spectrum copy into intermediate memory (Clipboard)

The presented spectrum can be placed into intermediate memory together with a selected comparison spectrum. Other WINDOWS programs can then be used for effective recording of the results.

This function can also be called up from the menu via **Edit** and **Copy**.

2.12. Determining element distributions

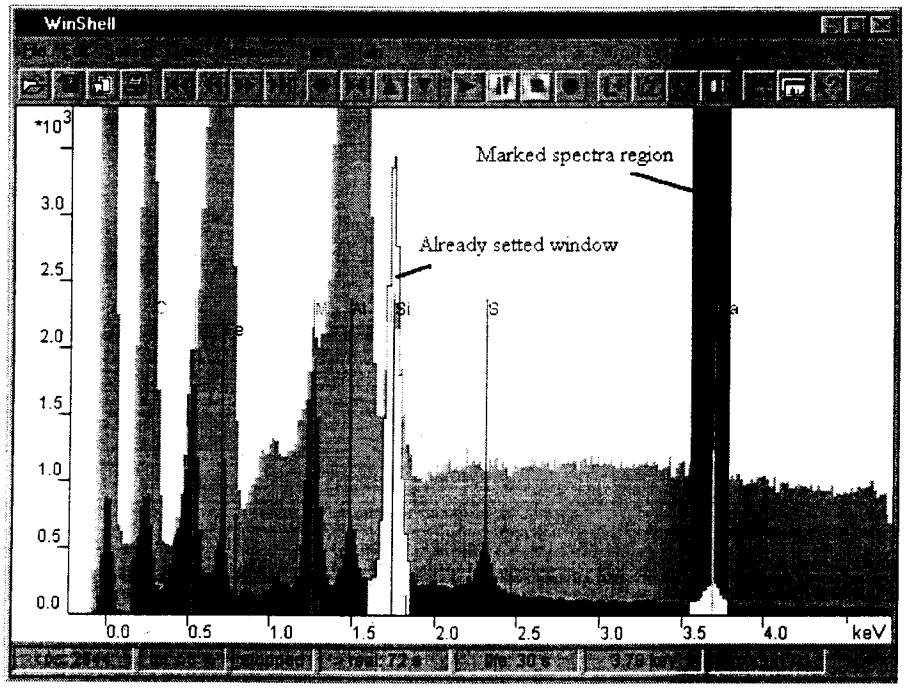
The **Edit** menu contains the functions **Measure windows**. Here, the energy ranges for the maximum of 15 element outputs can be set. If a spectrum range is defined by moving the spectrum cursor and at the same time pressing the right mouse key before **Measure Window** is called up, this spectrum region is taken over.



In **Settings** and **Measure mode** (cf. 2.2), **PulseMap** must be set.

In accordance with the windows set, all measured X-ray quantums are sorted, passed on to the corresponding outputs and output as TTL pulses.

The capacity to determine element distribution patterns, scans along a line on the surface and the number of channels depends on the features of the electron microscope used. As a maximum, 7 element distributions can be determined on 7 channels with option MultiElement.



2.13. Help system

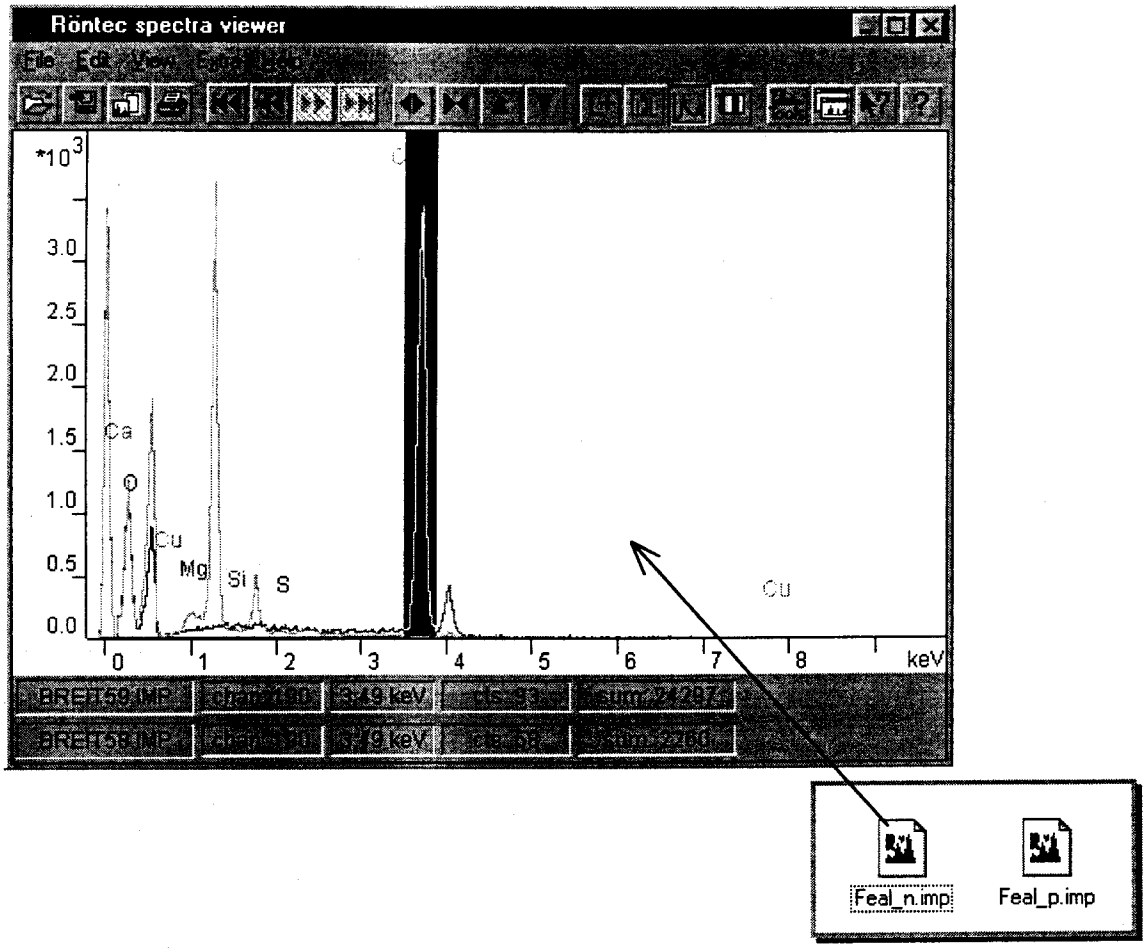
Various help levels have been integrated into the WinShell to meet different requirements. For the beginner there is both a context sensitive help and a measuring assistant available to lead him through the first measurements. The normal Help contains extensive information on measurement hardware, the INI files, error detection etc. in addition to explanations of the dialogs and menus.

2.14. Exit from WinShell

To exit from WinShell, use the icon shown or the normal WINDOWS functions.

2.15. Spectra Viewer SpcView

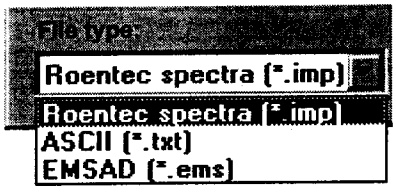
The operator is able to display and compare stored spectra with the spectra viewer SpcView. Qualitative evaluations of stored spectra are possible. Sum of pulses for both, foreground and background spectrum, are displayed after marking spectra region with right mouse key.



A direct link between ***.imp type files*** and ***SpcView.exe*** program is possible with Windows. All spectra files will be presented with the spectra viewer after left mouse key double click, if directories are inspected with e.g. Windows Explorer.

SpcView supplies ***drag and drop***. Operator can *drag* the icons of spectra files with right mouse key and move it to the open **SpcView** spectra display window. There the icon will drop. The spectrum will be loaded and displayed for operating.

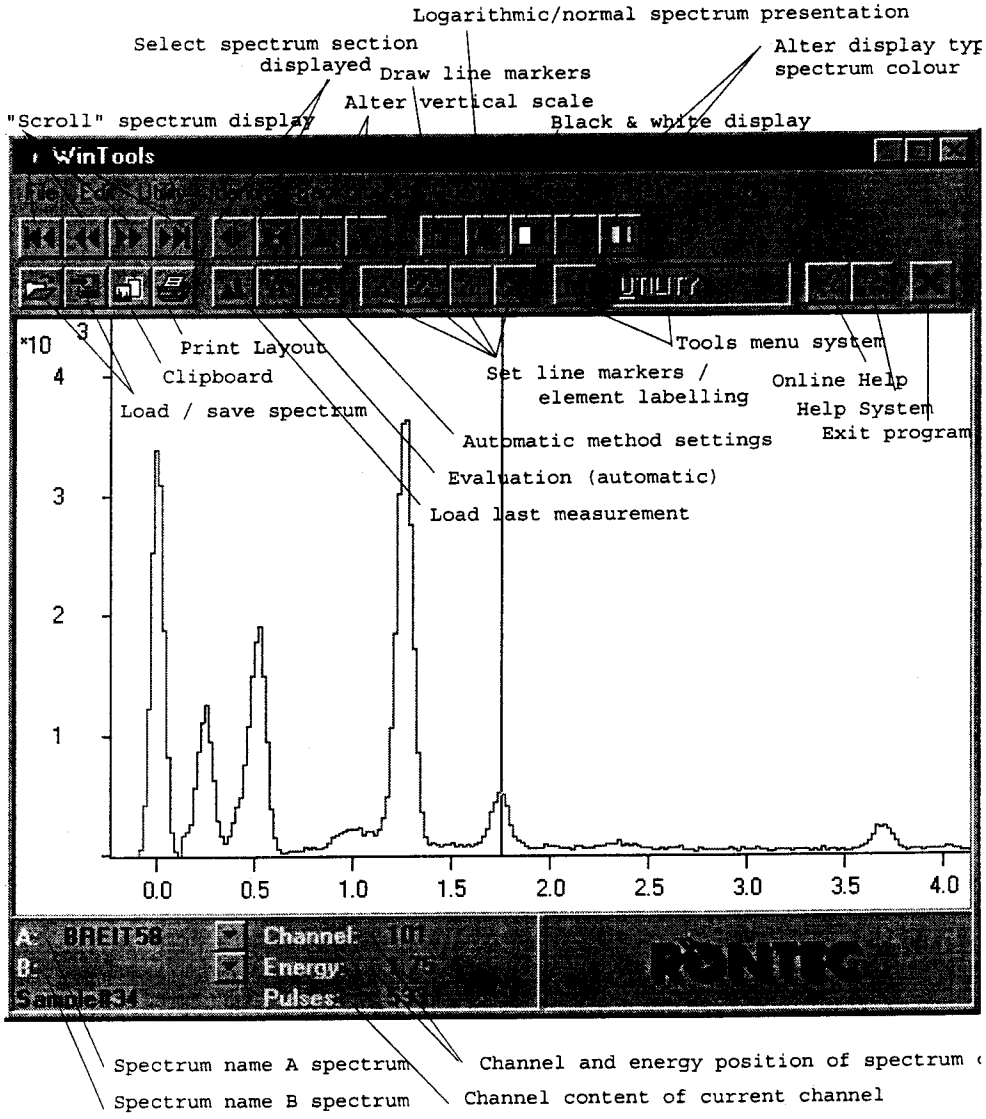
Both programs, WinShell and SpcView, have the feature of storing spectra to select not only RÖNTEC home format, but also ASCII- or EMSA-Code. Conversion of RÖNTEC spectra to other easy readable file codes makes data transfer to other programs easily.



3. Spectrum evaluation with WinTools

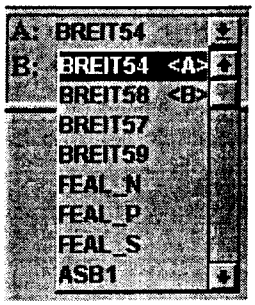
3.1. General information on WinTools

Complete spectrum processing and evaluation is possible with RONTEC WinTools (qualitative, quantitative, unstandardised and with standardised factors). The measurement must be completed and saved in RONTEC WinShell. When it is saved, the spectrum is allocated a name. The spectrum can now be loaded by its name.



The spectrum cursor is positioned with the arrow keys on the keyboard or by mouse clicking in the display field of the spectrum.

In addition to the icons, there are also a number of other possible actions on the spectrum display screen. The channel cursor is always moved when the mouse arrow is pushed into the direct spectrum display window and the left hand mouse button is pressed at the same time.



By a mouse click on A: or B:, the spectra loaded into the spectrum memory (RAM) can be selected from a menu and displayed.

Selecting this icon always loads the last spectrum which was measured and saved. It is immediately available for evaluation. It is of course also possible to evaluate spectra which have not directly been measured by using the normal file management function.

It is possible to evaluate the spectrum

- automatically by Start with icon
- via selected functions in the WINDOWS menu system

- via the full RONTEC Tools menu system.

These three levels of spectrum processing and evaluation are adapted to the different needs, prior knowledge and working tasks of the respective operator.

Using the printer symbol icon, operator will start printout of spectrum and resultes. Before printing, the system offers possibilities to change the layout of the one page (see chapter 2.4.). Possibly there is no link to the print program 'spcprint.exe' (in Folder WINSHELL). If there are no qualitative or quantitative results in printout page, please set in OPTIONS with result.txt output (see chapter 3.5.).

RONTEC WinTools is largely compatible with the description of the program system RONTEC Tools. Therefore, the "RONTEC Tools operating manual" is valid as a supplement to this description. Special features are described in chapter 3.7.2 .

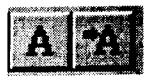
The right hand mouse button is not automatically identical with Esc. Some mouse drivers enable the right hand mouse button to be configured as Esc under WINDOWS. This setting is recommended because it makes work with just the mouse faster.

The spectrum window can be adjusted in its size and form by the normal WINDOWS method. A range of information, results and possible actions are presented in the display in separate windows. All of these WinTools windows can be moved in the display as individual WINDOWS objects. Their size is fixed. WinTools opens and closes these windows itself. When you exit from WinTools, all the windows are closed.

The "Info" window is of central importance. If this window is moved, it appears in this position again when it is next shown.

The result and action windows can also be moved, but the old position is active again when they are next opened. If the result and action windows need to be placed in a position that is different from the standard, this can be defined with Set window positions in the Options window (cf. section 3.5).

3.2. Automatic spectrum evaluation / automatic methods

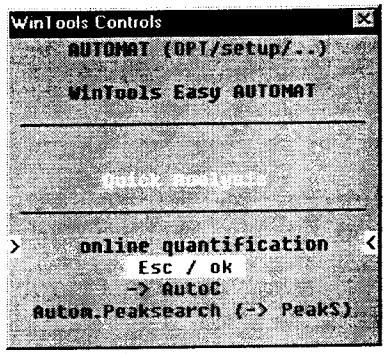


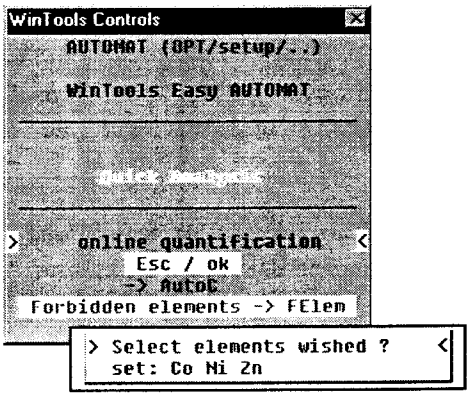
Automatic evaluation is started with the icon [A]. Depending on the pre-set automatic method, a completely automatic process or a more or less interactive process of evaluation of the spectrum displayed in the foreground (A:) is carried out.

The icon [-> A] is used to set and pre-select the automatic method.

In **on-line quantification** there are no interactive dialogs during spectrum evaluation. Depending on the basic setting of the system, either the elements set by line markers are evaluated as a qualitative analysis or an automatic peak search is called up. This basic setting can be selected with **-> AutoC** by an individual setting of the automatic function, and it then applies to all automatic methods except for the user automatic function.

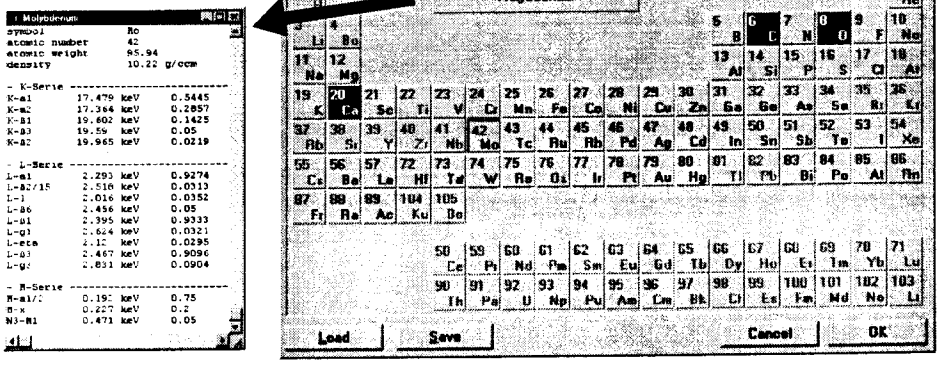
With element identification by setted line markers, it is possible to use **autom.Peaksearch (-> PeakS)** to call up a direct peak search. As a result, line markers are set. Further elements can be added or deleted with the Z icons. The quantitative evaluation of the elements found and set is then started via the automatic icons.

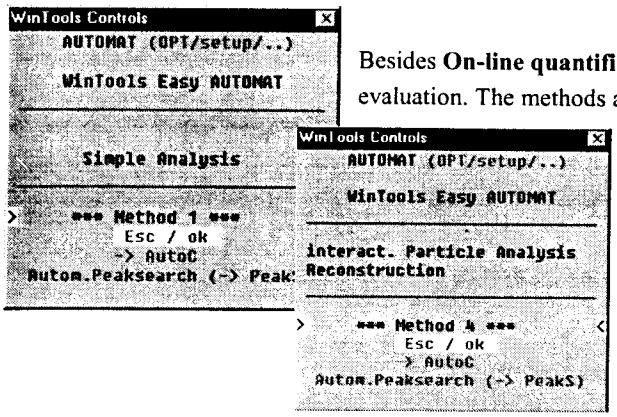




With an integrated automatic peak search, the qualitative analysis result can only be controlled by using the list of forbidden elements. Elements can also be set as "hard". To do so, first of all the function **Forbidden elements -> Felem** must be started in the menu. Unwanted elements can be marked as forbidden in the periodic element system. Then the function **Select elements wished?** is offered in the menu and can be used to set elements that are not found. Setting a element again, the program will delete it from current element set.

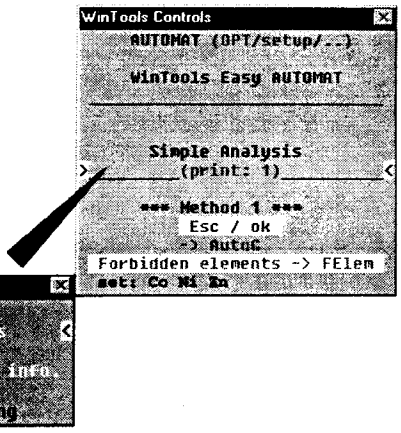
Further information on on-line quantification can be found in section 3.3.1.





Besides **On-line quantification**, there are a total of 5 methods of spectrum evaluation. The methods are switched in the position shown by means of a mouse click or by selecting the appropriate line and again pressing <Enter>. Parallel to this process, a short commentary on the performance of the current method is displayed in a window in the menu.

By contrast with on-line quantification, the spectrum evaluation process is more or less visible under the "methods".



A switch for control of spectra processing and evaluation printouts is selectable for every method. Operator gets a menu for printing method selection by a simple mouse click at corresponding position (use key-board if you like). 4 different ways are selectable to get analytical result outputs, ready to put into the clipboard, into a file or directly to the printer.

The 5 methods have roughly the following possible applications:

Method 1	Simple analysis	Polished samples, no interactive intervention
Method 2	Simple particle analysis	In addition to method 1, the real sample absorption is determined on the basis of the Bremsstrahlung. Rough surfaces and particles can be analysed.
Method 3	Bremsstrahlung interactive Reconstruction	In addition to method 1, the adjustment ranges for the calculation of the Bremsstrahlung must be set manually. The status and interim results of the individual procedures are displayed (e.g. deconvolution). After the output of the quantitative results, a spectrum is reconstructed and offered for comparison.
Methode 4	Interactive particle analysis Reconstruction	In addition to method 3, the real sample absorption is determined on the basis of the Bremsstrahlung. Rough surfaces and particles can be analysed.
Methode 5	Interactive with residual background Reconstruction	In addition to method 3, after calculation of the Bremsstrahlung, the residual background (if present) can be deducted interactively.

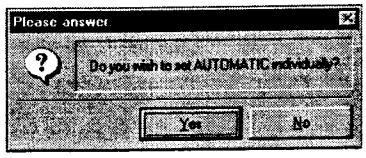
In all 5 methods, in connection with the display of the results, it is possible to delete elements. The concentrations are immediately recalculated with the updated list of elements without leaving the automatic function.

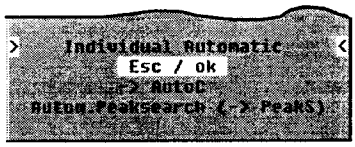
In all methods with reconstruction, it is also possible to identify further elements. The spectrum evaluation is then in a large loop in which elements can be deleted from the result output, and after the display of the reconstructed spectrum it can be decided whether further peaks should be identified.

3.3. Automatic spectrum evaluation / individual settings

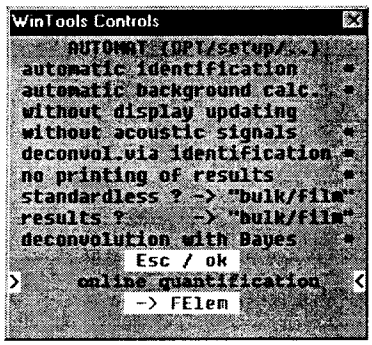
In general, on-line quantification and the 5 standard methods offered are sufficient for spectrum evaluation. In this case, you can skip section 3.3.

If the menu item **-> AutoC** is selected in the automatic settings, you can reach the mode for flexible individual settings of the automatic function after answering a security question:

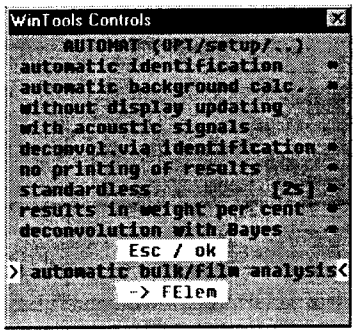




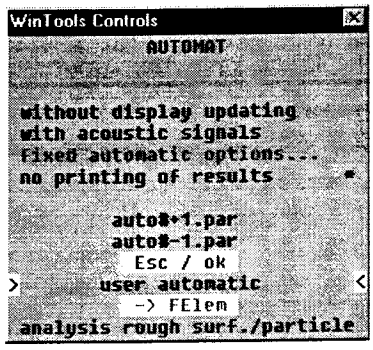
When the automatic settings are called up again, the status of the selection of an individual method is displayed.



Spectrum evaluation without further intervention possibilities (with "fixed" switches)



Spectrum evaluation with flexible intervention options for the individual evaluation steps (most flexible automatic function)



Spectrum evaluation with special or individual program sequence

The icon "**A**" is used to call up the function **Autom**, and the icon "**-> A**" is used to call up **AutoC** (cf. "RONTEC Tools operating manual").

The three basic modes for automatic spectrum evaluation can be switched by simply clicking with the mouse (at the marked position), and are described in sections 3.3.1 to 3.3.3.

The type of identification (qualitative analysis) can be selected with the first line of the menu (apart from "User automatic function"). "Automatic identification" can be controlled with the list of forbidden elements under the menu item "**-> FElem**" (cf. 3.3.1)

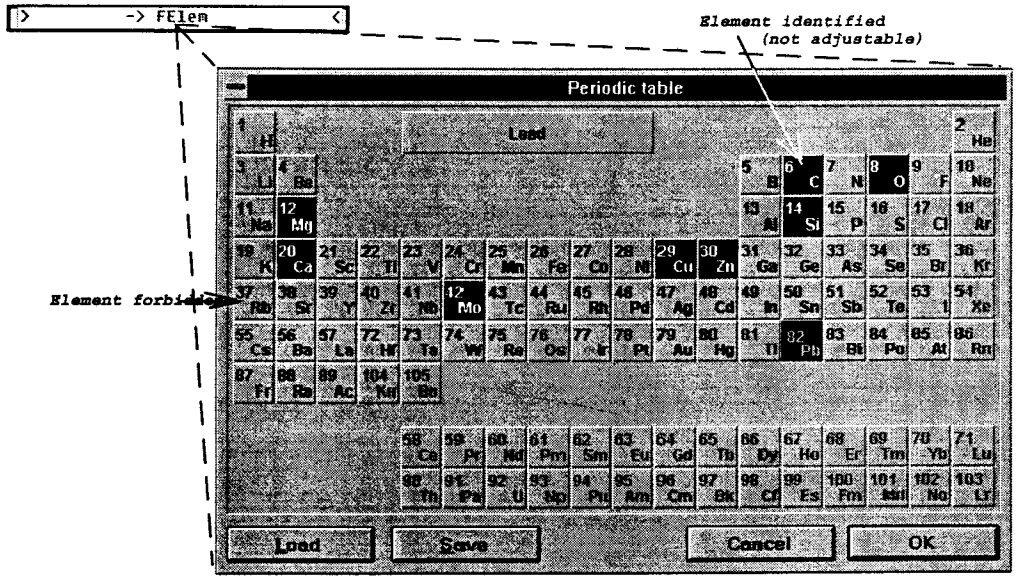
3.3.1. "On-line quantification"

In "on-line quantification", the operator is not forced to make any entries. Spectrum processing and evaluation are carried out in the background and cannot be seen by the analyst. Only the quantitative end result is displayed.

The elements must be set as line markers (*cf. 2.4. or 3.4.*). If no line markers are set or if a different kind of identification has been selected in the preferences, a peak search is automatically activated.

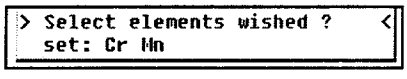
Therefore, the modification options for the evaluation process are limited. The type of result obtained (atom or % of mass, error) is in accordance with the settings in Autom. "bulk/film" analysis.

If the function is ***not*** switched to take over LM -> Ident autom., an automatic element identification is included. This automatic identification can only be controlled with a list of forbidden elements (mouse click on **-> FElem**).



The list of forbidden elements can be edited simply by clicking with the mouse. The software contains a certain basic setting for forbidden elements which can be temporarily changed at any time (click on **O.K.**) or can be modified for later program sequences (**Save**). After a temporary change, **Load** restores the basic setting. The elements found during the last identification process in the current spectrum are displayed (not the line markers set!).

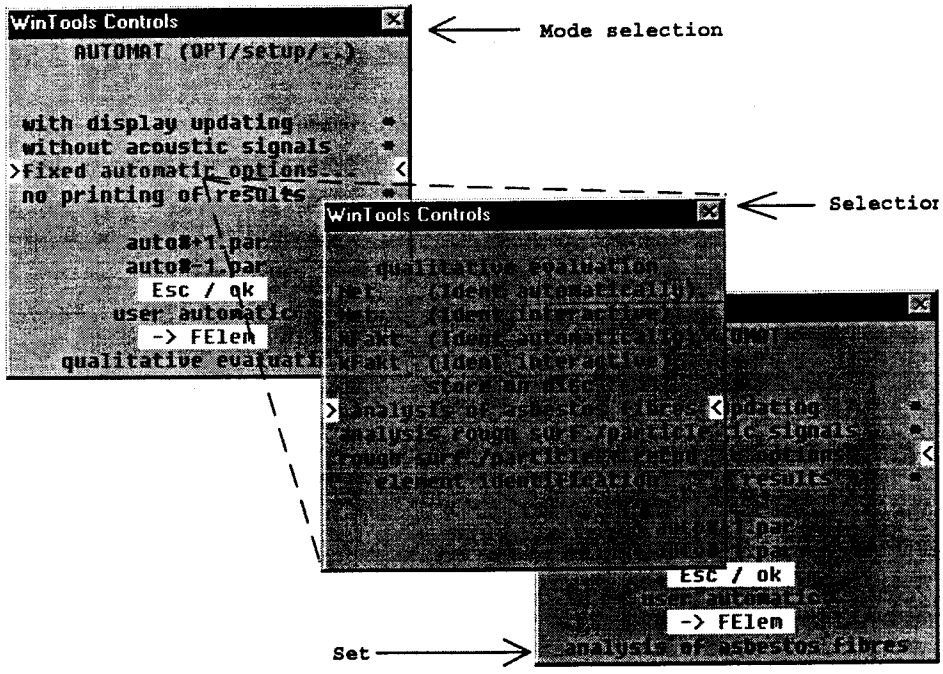
After **O.K.**, the operator has the possibility to set elements for automatic identification. The option -> FElem is modified to Select elements wished ? to take selected elements into account. Selection is again made via the periodic system of the elements. An element that is set must not be forbidden at the same time. An element that is set can be deleted by setting it again.



A skilful combination of prohibition of unwanted elements and setting of unidentified elements can have an influence on the qualitative and quantitative analysis. After the function has been restarted with icon 3, an automatic evaluation is carried out under the new conditions.

The mode for peak search / peak allocation can be modified in the text file "toolcfg.cfg" (self-explanatory). Mode 1 is recommended as standard.

3.3.2. User automatic function



Here, a number of special automatic program sequences can be selected.

qualitative evaluation	Identification of the elements interactive, result of qualitative analysis
Net (Ident automatically)	Identification of elements automatic, result: net peak numbers
Net (Ident interactive)	Identification of elements interactive, result: net peak numbers
analysis of asbestos fibres	Evaluation according to VDI 3492, details of class / asbestos type
analysis of rough surf./particle	Analysis of rough surfaces and particles, result of quantitative analysis after optimisation of absorption
rough surf. /particle + recon.	Analysis of rough surfaces and particles, result of quantitative analysis after optimisation of absorption, reconstruction of spectrum (see section "bulk/film" !)

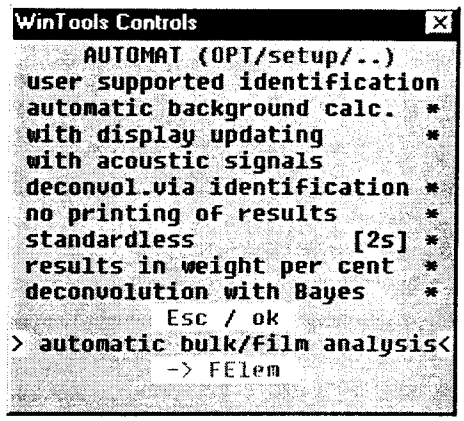
In the user automatic function, 3 switches can be set to afffect the evaluation process. If With display updating is active, all spectrum processing can be observed live on the monitor. If No display updating is set, the spectrum is only updated when the result is displayed.

Acoustic signals can be switched on or off. If required, they can support the flood of visual information and relieve the operator's eyes from tiring tasks.

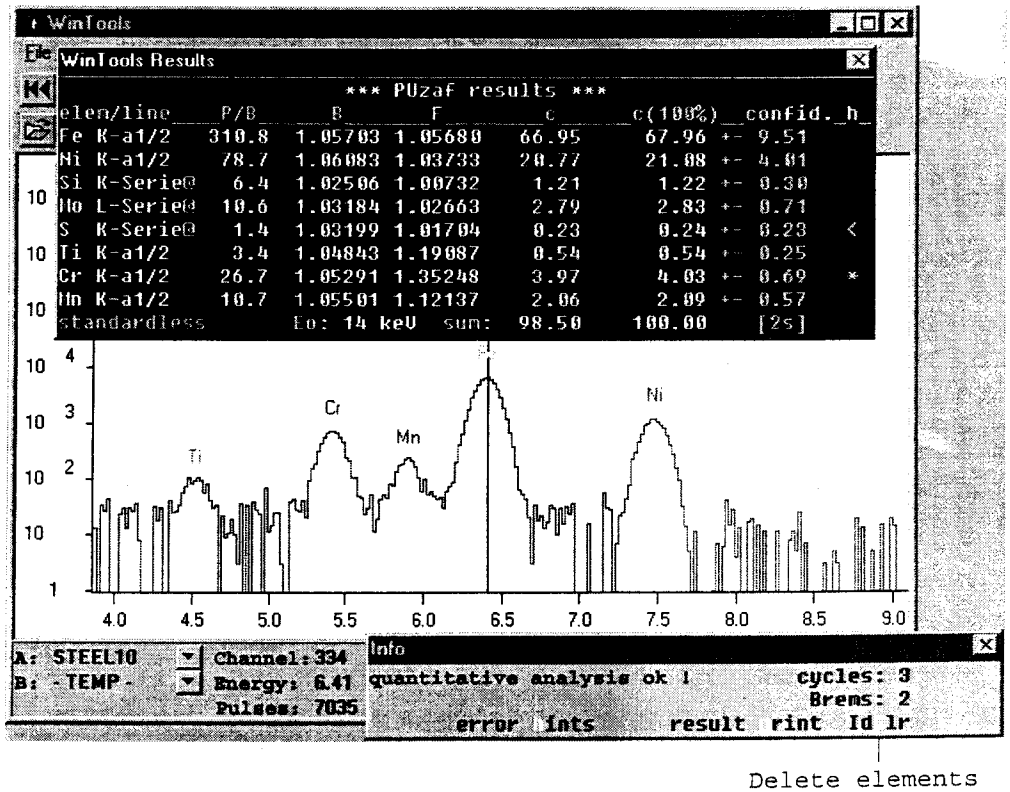
It is possible to select automatic printing of the result. If With printing of results (or other printing options) have been activated, a dialog follows and the log data streams are passed to a separate window under WINDOWS. In this window, the result log can be directly printed out, transported into intermediate memory or saved to a file.

3.3.3. automat. "bulk/film"-Analyse

The third variant of automatic spectrum evaluation offers most modification possibilities. In each case, the operator is guided through the individual processing and evaluation steps. He also has the option of modifying individual steps in a differentiated manner. If the switches are set accordingly, automatic program processing is interrupted and control is handed to the operator, e.g. to define adaptation ranges for Bremsstrahlung calculation. The guidance for the operator is provided in an understandable dialog. After the operator's entries have been completed, the remainder of the program processing is then automatic again until the result is achieved.



The 5 methods of automatic processing offer a small selection of the modification options for automatic "bulk/film" analysis (see section 3.2.).



After the display of the result, it is possible with result print to output the result immediately on a printer (only if automatic result printing is not agreed). With IdClr it is possible to delete elements selectively from the results list. This leads to a complete re-evaluation of the spectrum. With error hints, the analyst is given information to help in the interpretation of the results, and possibly to optimise the excitation of the elements or the evaluation of the spectrum.

Here, the various switch positions to modify spectrum processing and evaluation will only be explained briefly. Further information can be found in the integrated operating manual and the "RONTEC Tools operating manual".

```
automatic identification    *
user supported identification
identification by operator
take over current identific.
take over LM -> Ident autom.
take over chart - ident.edr -
```

The switches for element identification are self-explanatory. For switches 2 and 3, a dialog must be carried out during identification. The operator can enter the elements either with the support of the peak search or completely independently. For each element, the desired line series must be selected and a summation range must be specified if no spectrum reconstruction (switch for deconvolution) has been selected. If <Esc> is pressed during the entry of the range, the corresponding line series is explicitly prescribed for a deconvolution sequence. If summation ranges overlap, the software automatically sets the corresponding elements to deconvolution sequence. In a spectrum reconstruction, each line series used to gain the quantitative analysis results must be deconvoluted. Here it is not necessary to enter the summation range boundaries. The final menu of interactive or manual identification permits the entry of additional elements (cf. integrated manual via "?" and the RONTEC Tools operating manual).

With the switch position take over current identific., the last element identification is always taken over. In this way, a series of spectra with identical element identifications can be studied in terms of the quantitative differences.

With take over LM -> Ident autom. it is possible to carry out identification during the measurement process. When the evaluation is called up, only the set elements are used to gain the result. But the operator has no influence over the line series evaluated and their range boundaries.

With the switch position take over chart - ident.edr -, a fixed identification list is taken over which can be created and edited as an ASCII file with the name "ident.edr" in the main directory of the program (cf. example). In each identification, these elements are accepted with the selected lines in a similar way to the line marker identification.

```
S  K
Mo L
Pb M
```

```
automatic background calc. *
peak search+autom.background
background with region input
input without cursor preset
```

Only switches 1 and 3 are interesting. If the background adaptation is not satisfactory, the operator can intervene with background with region input.

The following switches are responsible for deconvolution:

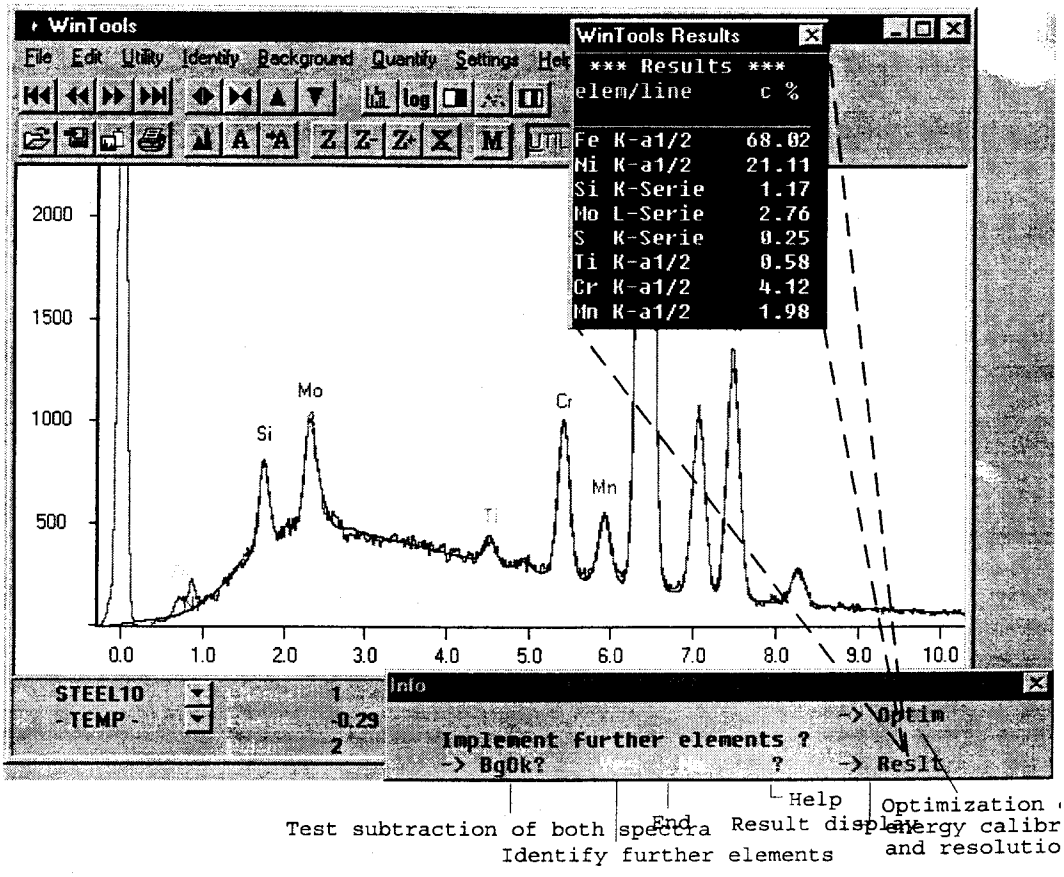
```
deconvol.via identification *
spectra reconstruction
```

With deconvol.via identification, all lines to be deconvoluted are determined on the basis of the identification list (control by user supported identification). It is also decided automatically which additional line series must be taken into account in the proposed deconvolution.

After selecting the switch spectra reconstruction, each identification is processed without any request for the range boundaries. Deconvolution is planned in all cases. After leaving the results list, the comparative spectrum is shown overlaid over the corrected original spectrum.

Taking into account further elements and with IdClr in the result display, complete control of all elements included in the quantitative analysis can be achieved. If an element proves to be undetectable (below the detection threshold), it can be deleted. The quantitative calculation is then immediately repeated without the element. If it is noticed in the reconstruction that the spectrum contains peaks or structures that are not yet identified, identification can be used to help search for additional elements. Here, too, the quantitative evaluation is automatically repeated.

It can be continually optimised until the measured spectrum corresponds as fully as possible to the reconstructed spectrum:



Using ->Optim an optimization of the energy or/and peak width calibration can be activated in the case of deviation of the reconstructed spectrum in peak positions or resolution. This facility is especially useful for the operator when XFlash spectra are being evaluated.

Peak width optimization occurs at the zero energy peak; to optimize the peak position it is necessary to select an element line that is clearly present in the spectrum. In the case of successful optimization a completely new calculation of the results of the analysis takes place with renewed reconstruction.

The type of unstandardised evaluation (only for radiation inlet windows which permit an analysis of the light elements) and the reliability range of the statistical error can be adjusted.

```
standardless              [2σ] *
standardless,Z<11 diff.[2σ]
standardless              [1σ]
standardless,Z<11 Diff.[1σ]
```

Switch positions with 'Z<11 Diff.' are only available for spectra of lew/slew detectors and switch the mode for light element quantification oleQ for bulk samples!

These switches control the quantitative output of results:

```
results in weight per cent *
results in atomic per cent
weight per cent/ relat.error
atomic per cent/ relat.error
% oxide/ relat.error
```

It can be determined with AUTOMAT, 'Options?' whether a thin layer (film) analysis is carried out.

Here, an incomplete analysis by stochiometry taking into account oxygen can also be selected.
Only then is the switch % oxide/ relat.error active.

If the Bremsstrahlung calculation is not ideal, a residual background deduction can be added to the automatic evaluation process after the Bremsstrahlung calculation:

```
deconvolution with Bayes
remain.backgr. LinB + Bayes
remain.backgr. PolyB + Bayes
```

The calculation of the residual background (switch position 2: with linear residual background; switch position 3: with polynomial residual background) is always carried out with manual request of the adjustment ranges and cannot itself be automated. In a reconstruction, the deduction of a residual background is taken into account.

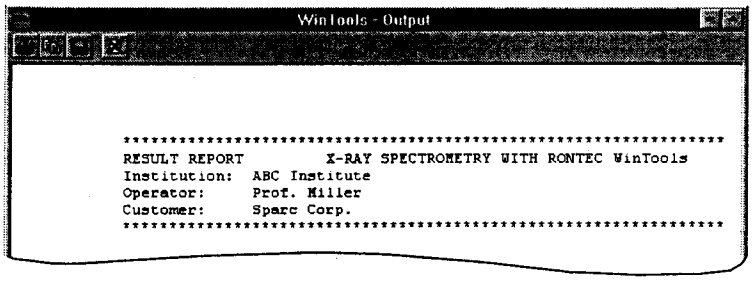
The remaining switches were already dealt with in the section "User automatic function", and they have the same meaning here.

3.3.4. Automatic recording of results

It is possible to create an automatic results print-out. If with printing of results or some other print option is activated a dialog takes place and the record data flows are diverted to a separate (WINDOWS) window. In that window the results report can be printed directly, transferred to the clipboard or saved in a file.

```
                no printing of results      *
                with printing of results
                keeping the minutes
                with pr.results + error info.
                result output tabulated
```

In the first printing job, the operator is asked if a log header should be generated. The standard header has the appearance shown.



The appropriate data must be entered. The log header is fitted into the printed record in a fixed form. If a new log header is needed in the course of the work (e.g. for a change of subject), it is necessary before the next printing job to call up Print a text line under AUTOMAT, "Options?" (output: # ; cf. section 3.5.). Here, a direct comment can also be added to the current log.

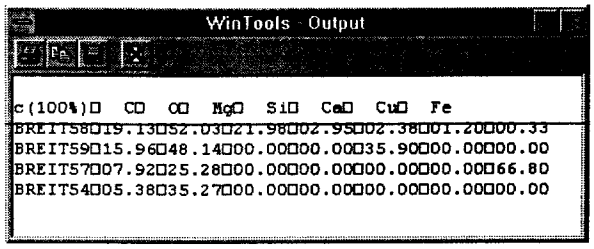
If a different log header is required (e.g. with company names etc.), a text file with the name "head.txt" must be created in the WinTools directory. Instead of the integrated log header, the content of this file is used as a header. There is no interactive dialog. Of course, it is also possible to edit this file constantly and actively, e.g. with the system editor.

```
=================================================================
RESULT REPORT          X-RAY SPECTROMETRY WITH RONTEC WinTools
Institution:  ABC Institute
Operator:     Dr. Miller
Customer:     Sparc Corp.
*****************************************************************


*******************************   *******************************
    RONTEC EDWIN WinTools          BREIT59     7.10.1997 ( 9:54)
*******************************   *******************************
      version: 3.0 eng             Eo:14.8 keV  (TO:30.0  TI:-6.0)


                     *** PUzaf results ***
elem/line____P/B_____B_______F________c_____c(100%)__confid._h_
C  K-ser   @Coat?  1.00000 1.00000   15.01      15.20  +- 1.95  n
O  K-ser   @       1.00000 1.00000   46.24      46.81  +- 6.17  n
Ca K-alpha @407.1  1.02502 1.01129   37.52      37.99  +- 4.38
-----------------------------------------------------------------
standardless                         98.77     100.00      [2s]
```

In the switch position keeping the minutes, both the results and all intermediate steps are printed. Under with pr.results + error info., the error information is also logged at the end of a quantitative evaluation. With the switch position result output tabulated, the output can be printed as a table directly to a printer or into a file for use in a spreadsheet program.

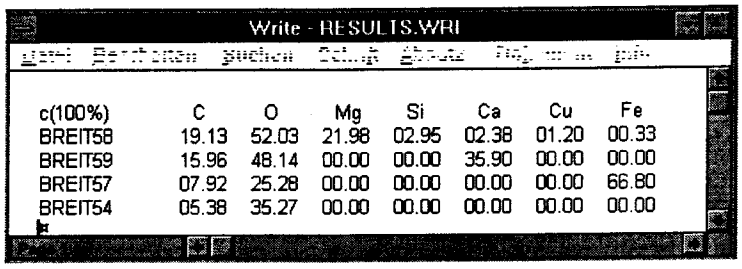
After the tabular results output is set (result output tabulated) the program asks whether the current spectrum elements identified should be accepted (identification by means of the automatic or **Ident** function; it is not sufficient to set line markers!). If the answer is yes, all the elements are adopted as a table heading. All subsequent spectra evaluations insert the relevant results in the prepared table. Elements that are not identified in a later spectra evaluation are assigned the concentration 0%. Elements that are identified in a following spectrum evaluation but are not entered in the table heading are not inserted.

Thus when the tabular results output is switched on all the expected elements must be identified in a sample spectrum.



The individual values in the table are separated from one another by tabs. The table can be printed directly. Using the clipboard the results can be inserted into a word processor or table calculation program for further processing.

The appearance of the table as it is printed directly or in the program in which it is to be further processed depends mostly on the capabilities and the settings of the printer or software (the example using "Write"; see section 4).



3.4. Automatic analysis with line marker identification

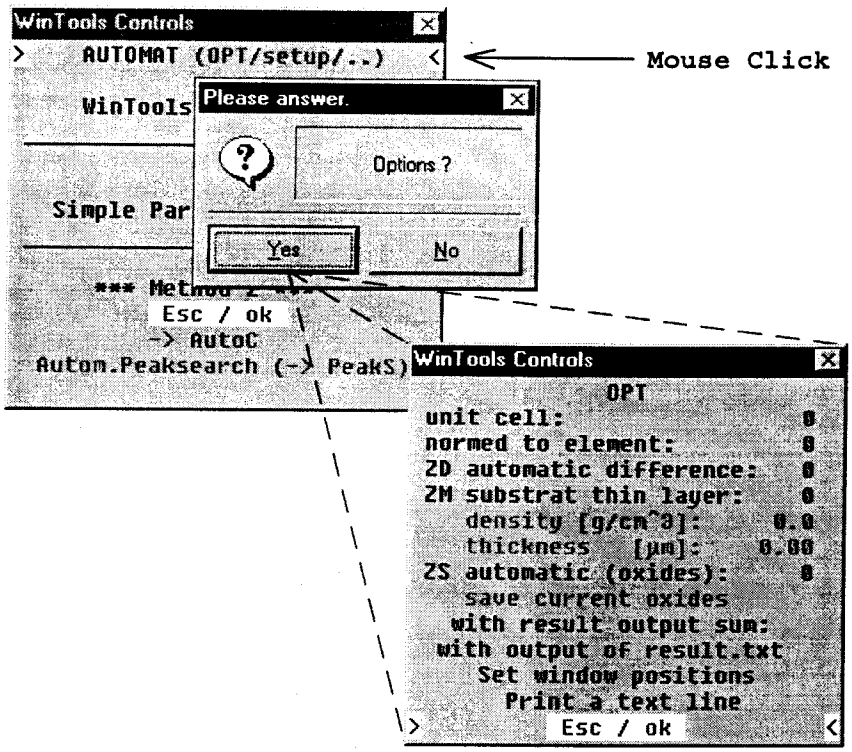
The line markers mark the peak positions that are anticipated for the corresponding energy levels. The relative height of the line markers approximately symbolises the anticipated intensity of the lines in a series in relation to each other.
In connection with the switch for element identification, take over LM -> Ident autom. a very effective definition of the elements for analysis can be carried out. After the automatic function is started, the corresponding elements are then also marked in the periodic system.

If no line markers have been set or all line markers set are previously deleted, an additional automatic peak search takes place before quantitative evaluation.

The setting of the line markers, and thus the qualitative analysis, can of course also be carried out in WinShell during the measurement process.

3.5. Options, basic settings for WinTools and on-line help

Under AUTOMAT, a special control function can be found (options):



If the **unit cell:** contains a number other than zero, all results in % of atoms are output standardised to this number. Even if the setting is for output in % oxide/ relat.error, the value is switched from an output in % of mass of oxides to a figure for oxides as a proportion of atoms, standardised to this elementary cell.

Under **normed to element:**, an ordinal number can be entered. Whenever this element is present in the identification list and the option **unit cell:** is not occupied, the output is related to this one element which receives the atomic proportion 1 or the number corresponding to the value in **unit cell:**.

It is possible to set an element for the analysis of the difference (ZD). A substrate element (ZM) (thin layer analysis, "film") or taking an element into account by stochiometry (ZS / only for oxygen oxides) can also be prescribed for each automatic identification. The menu item **Save current oxides** takes over the stochiometry relationships entered in the current spectrum by semi-automatic or manual identification (and only them) for all later automatic identifications. If there is any change to the fixed stochiometry, all potentially interesting elements (a maximum of 20!) should be entered in one spectrum by manual identification with their stochiometric relationships to oxygen (select ZS at the end of the identification). All other elements are assumed to be atomic in the automatic consideration of oxide.

If an ordinal number of 1 is entered for ZM, it is taken into account as a self-supporting layer (not a substrate).

Therefore, even in automatic identification it is possible to carry out an incomplete analysis or to mark a spectrum as a film problem.

For **ZD**, **ZM**, **ZS** no elements with an ordinal number of < 11 can be directly identified and evaluated (if necessary forbid them in **-> FElem**!).

The standard output for unnormalised results of the function **PUzaf** can be carried out under with result output sum:.

```
with result output sum:
c(100%)result outp. only
result sum: /without B+F
c(100%)only /without B+F
```

In this case, there is always only an output of the second column of the concentrations in the result lists (defined in accordance with the switch positions).

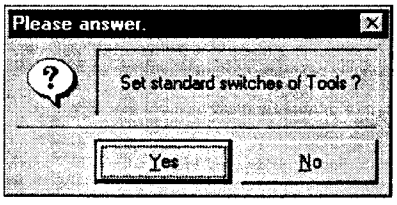
Independently of the normal log printout, which can also be made to a file instead of to a printer, it is possible to create a permanent result log to a file with the name **result.txt**. This file is saved to the same file directory in which the RONTEC program system is saved. By contrast with the log printout, the file is closed after each output. In the next result output, the old text is overwritten. This means that a permanent live access of other programs to the analysis results is possible in multitasking operation.

```
no output of result.txt
with output of result.txt
result.txt / no stop
with output of "name".txt
"name".txt / no stop
```

In automation (e.g. for linking with other computers), selection of the third option means that the unnecessary and time-consuming display of the results on the device display no longer takes place.

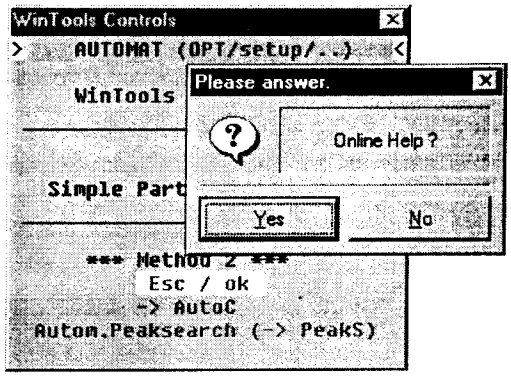
Set window positions enables the fixed first positions of the result and action windows to be changed. A dummy result window (blue) and a dummy action window (white) without content are displayed. Both windows can be freely moved on the screen. After pressing the Esc key (mouse operation is not possible), the selected window positions are saved. All result and action windows in WinTools are based on the positions of the two dummy windows. Even after a restart of the program, all window positions are still valid in their changed form.

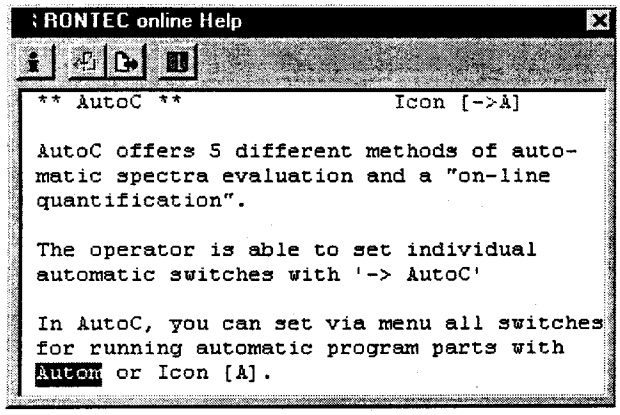
Print a text line enables a prompt comment to be added to the current log (printer or result file).



If the operator answers to question 'Options ?' with 'No', he will get the question 'Set standard switches of Tools ?'. By positive answer all switches for quantitative spectra processing and evaluation of AutoC und ToolC will be set to the default values.

If you answer the question "On-line Help?" with "Yes", the integrated help function is permanently shown in a separate window under WINDOWS. The Help topic is constantly updated in accordance with the current function and the entries required by the program. It is also possible to enter the keyword "onlinehelp" in the toolscfg.edr and to activate this mode every time the program is started.

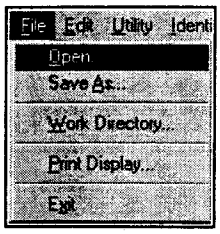



RONTEC online Help
** AutoC ** Icon [->A]
AutoC offers 5 different methods of auto-
matic spectra evaluation and a "on-line
quantification".
The operator is able to set individual
automatic switches with '-> AutoC'
In AutoC, you can set via menu all switches
for running automatic program parts with
Autom or Icon [A].

Cross references (highlighted in colour) can be referred to at any time by clicking with the mouse. Scrolling in the current topic can be carried out with the aid of the normal keyboard keys or with the icons shown at the top of the window.

3.6. Spectrum evaluation with the WINDOWS menus

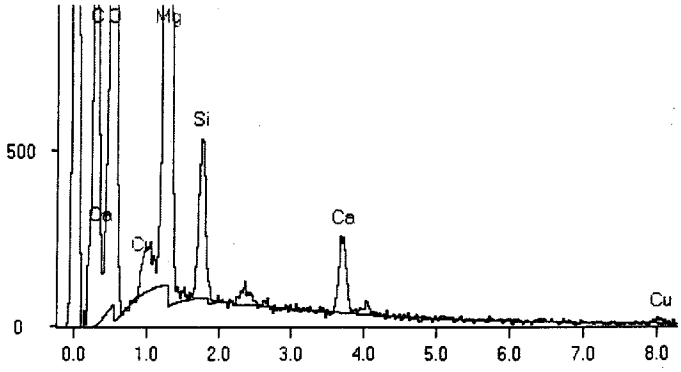
The WINDOWS menus in RONTEC WinTools provide a selection from the full range of function of the Tools. Both first menus are common in Windows and are dealing with spectra handling.

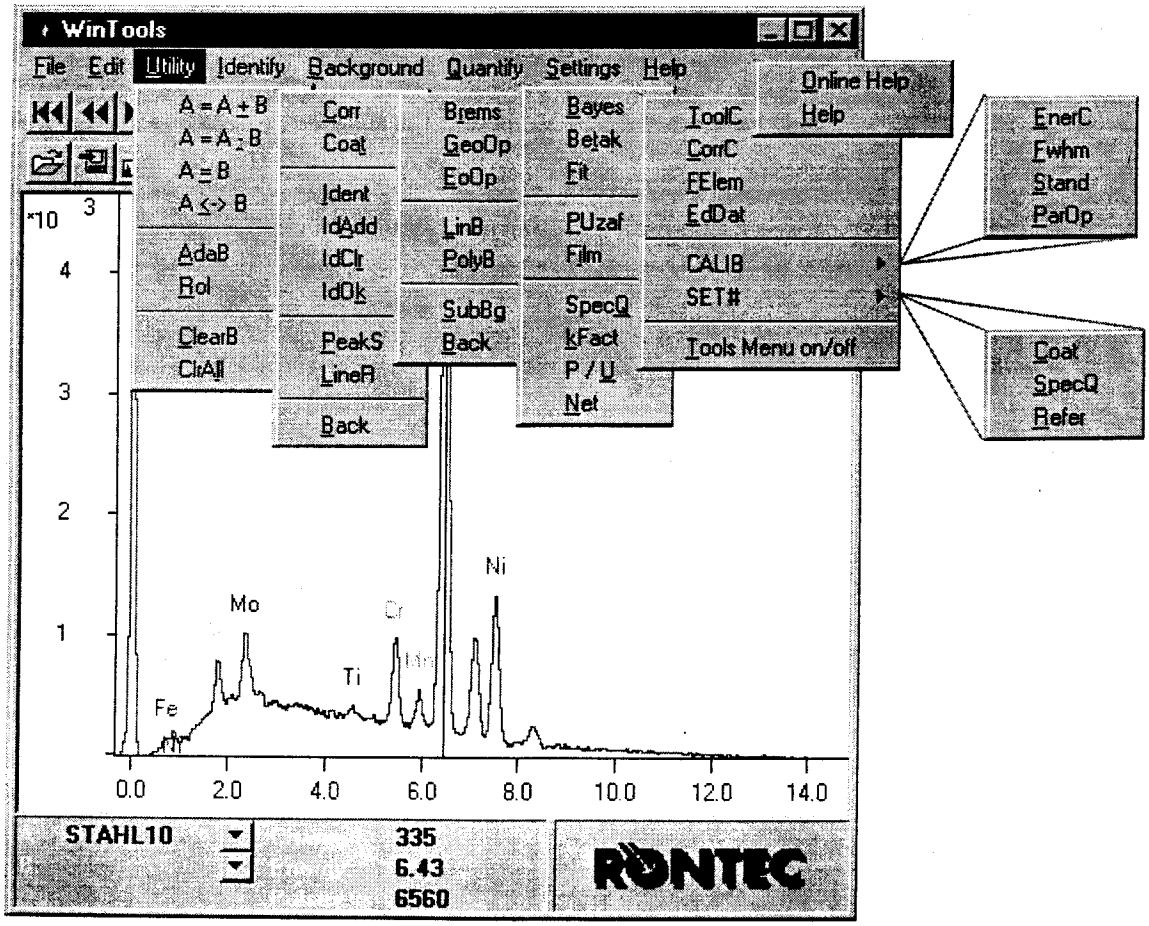


The menus **File** is self-explanatory.

or

With **Edit** and **Copy**, the current spectrum display can be copied to intermediate storage. Other WINDOWS programs can then process the spectrum images (pixel images), e.g. to prepare an analysis report.





Utility

A=A+B	Addition of both visible spectra
A=A-B	Subtraction of both visible spectra
A=B	Copy of spectrum B to A (deletes A)
AdaB	Adaption of calculated or measured background spectrum
RoI	Sum of all pulses in free selectable regions of interest (A and B)
ClearB	Deletes spectrum B
ClrAll	Deletes all spectra in main store (RAM)

Identify

Corr	Spectra correction (Esc, Shift, Shelf, Tail - according settings in Settings CorrC)
Coat	Coating correction of Carbon
Ident	Identification for quantitative analysis (settings in Settings ToolC / 1. switch)
IdAdd	Identification of further elements
IdClr	Deletes identied elements
IdOk	Takes over last set of identified elements (not line marks!)
PeakS	Peak search, setting of line marks (do not substitute Ident!)
LineR	Changes identified line windows set in spectrum (other ROI's)
Back	Backup of last spectra processing state / Backup last spectrum with Bremsstrahlung

Background

Brems	Calculation of Bremsstrahlung background (Settings ToolC / 2. switch)
GeoOp	Variation of specimen tilt angle for Bremsstrahlung calculation
EoOp	Variation of primary electron enenergy for Bremsstrahlung calculation
LinB	Calculation of linear background (Settings ToolC / 2. switch)
PolyB	Calculation of polynom background (Settings ToolC / 2. switch)
SubBg	Subtraction of calculated or fitted background
Back	Backup of last spectra processing state / Backup last spectrum with Bremsstrahlung

Quantify

Bayes	Devonvolution (probability theory based) (Settings ToolC / 5. switch)
Betak	Peak stripping (subtraction of all Kß- lines)
Fit	Peak fit (linear parameter optimization) (Settings ToolC / 5. switch)
PUzaf	Quantitative correction procedure (matrix correction) standardless or with standard factors (Settings ToolC / 7. switch)
Film	Analysis of thin layers standardless
SpecQ	special quantitative procedure (Settings ToolC / SET# / SpecQ)
kFact	Calculation of ne counts in relation to acquisition time, reference value for standard comparison analysis / data transfer to MultiQuan (Settings ToolC / SET# / Refer)
P / U	Display of Peak/Background- values with statistical errors
Net	Display of net counts values with statistical errors

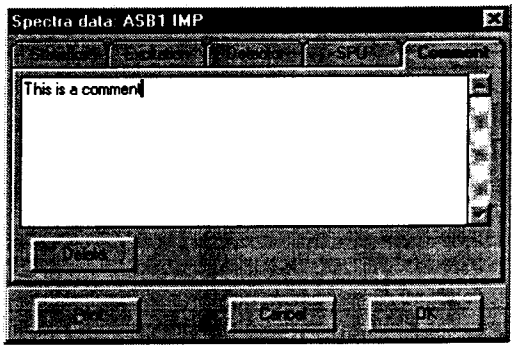
Settings

ToolC	Setting of switches for manual spectra evaluation
CorrC	Setting of switches for spectra correction (Corr)
FElem	Setting of forbidden elements (automatic identification)
EdDat	Edit of spectra parameter / spectra comment
CALIB EnerC	Energy-channel calibration
CALIB Fwhm	Determination of energy resolution
CALIB Stand	Edit / calculation of standard factors for PUzaf
CALIB ParOp	Optimization of Bremsstrahlung fitting via variation of physical experiment parameters
SET # Coat	Calibration / Settings of Coat correction
SET # SpecQ	Method setting for SpecQ function
SET # Refer	Setting of reference method / MultiQuan for function kFact
Tools Menu on / off	Fade in / fade off complete Tools menu system including function key driving possibilities

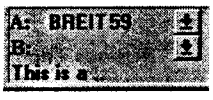
Help

Online Help	short, self changing help window
Help	integrated manual

With **EdDat**, all parameters of the A spectrum can be modified. In addition, a spectrum comment can be edited. The comment is an integral part of the spectrum parameter block, and it is saved with the spectrum.

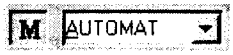


The first line of the spectrum comment is output in abbreviated form below the current spectrum names for A: and B:



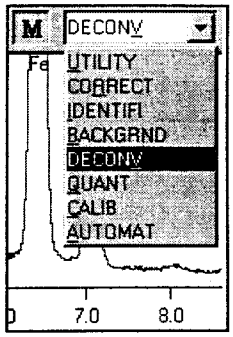
If a new spectrum comment is to be saved in the archive, please edit the comment in the unprocessed original measuring spectrum or save the commented and processed spectrum under a modified file name.

3.7. Spectrum evaluation with the full RONTEC Tools menu system



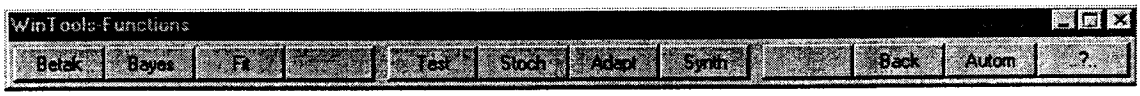
Even with WinTools you can make use of the full range of functions of the tried and tested program system RONTEC Tools for processing and evaluation of energy-dispersive measured X-ray spectra.

3.7.1. Switching on and operating the RONTEC Tools menu system



The function keys of RONTEC Tools are displayed by clicking onto the icon [M] or by selecting the WINDOWS menu item "Old style menus". If a different functional menu is to be selected, the corresponding selection must be made next to [M]. The content of the function bar changes immediately.

The individual function menus can still be scrolled with the keyboard ("page up" and "page down") or directly with the highlighted letter. In this case, the corresponding menu designation is directly displayed in the prescribed window.



The separate WINDOWS window "WinTools functions" shows the assignment of the function keys F1 to F12. The functions can also be selected by clicking the appropriate position with the mouse. As the function key bar is a separate WINDOWS window, it can also be removed from the desktop into the symbol, where it can be called up again at any time.

3.7.2. Special features of WinTools / stock evaluation / remote control

The RONTEC Tools under windows, in the form of WinTools, do not have an Alt-function key menu. The individual analytic functions are explained in the "RONTEC Tools operating manual", and are identical in content with the functions under WinTools.

The RÖNTEC Tools menu system can be navigated very effectively using the keyboard. Any function can be started using just two keys if the functions menu is selected by means of the highlighted letter or the <page up> or <page down> key and then activation of the function key. The mouse is needed only to start the RÖNTEC functions assigned to <F10>, since the <F10> function key is used under Windows to enter the WINDOWS menu system.

According to the "RONTEC Tools operating manual", settings for functions (e.g. SpecQ) can be started by entering '#' after calling up the function.

In WinTools, the WINDOWS menu system (**Settings** and **SET#**) must be used. Alternatively, the setting can also be carried out in the Tools menu with the mouse. The corresponding function can be fixed by holding down the mouse key, releasing it ant then holding it down again to move it to the required operator level.

Functions **Spect** and **Point** are in **AUTOMAT** menu. Functionality differs from describtions in "User's Manual for the RÖNTEC Tools":

Both functions are devoted to *stock evaluation* of a series of spectra *directly* or with *remote control*. Spectra will be evaluated with via icon **[->A]** or **AutoC** selected automatic mode. The operator is able to select between all automatic spectra processing and evaluation schemes, including user automtics with the makros, recordable via **Learn** and **End** ('user automatic'). For evaluation high number of spectra, switches should be setted convinient, depending of the task:

1. During spectra evaluation unnecessary interactions should be avoided (identification, background regions,...), otherwise operator has to interact for every spectrum.
2. WinTools waits after every result display (PUzaf, Film, ...) for a operator quit. Before that, no further operations will done. This quit is avoidable due to
   a) setting of any kind of automatic result printout.
   b) setting via **[->A] AUTOMAT (OPT/setup/...)**, answer to question **'Options ?'** with 'Yes', select switch **result.txt / no stop** or **"name".txt / no stop** .

In the case a) all results will be collected in a special text window for later usage. In the case b) program stores the results in file 'result.txt' into WinTools directory for every spectra evaluation. The program writes over this file after result display of the next spectra evaluation (convinient only with function **Point** only, if result.txt evaluated with other programs before next spectra evaluation of WinTools). With switch "name".txt WinTools writes files with spectra names and extension '.txt' into the current spectra directory. Operator or programs are able to assign all result files of spectra archiv via spectra names later.

Spect

With special automatic function **Spect**, operator can evaluate a series of spectra. First he will forced to input the name of the first wished spectrum name.

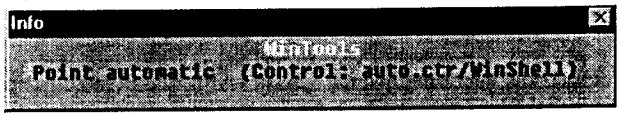
Example:	SP1.IMP	evaluation of all spectra:	SP1.IMP . . . SP9.IMP
	SP001.IMP	evaluation of all spectra:	SP001.IMP . . . SP999.IMP

Spectra name series must have no gaps. After evaluation of last spectrum in name series, program terminates with an error information about searching the first spectra name, which is not in series!

Point

With special automatic function **Point**, operator or other programs are able to control automatic WinTools spectra processing and evaluation with a special named file 'auto.ctr' (directory of WinTools) or after spectra storige of WinShell (erwin.ini in WINDOWS directory, modified from WinShell automatically!).

After call of **Point,** WinTools goes into a wait position:



WinTools activates evaluation of next spectrum immediately after updating one of th two possible control files with other programs (text editor or other master programs for EDWIN remote control) . Operator can cancel remote control wait state only with **<Esc>** key.

The control file 'auto.ctr' is to design in ASCII text format and includes in the first line both, path and name of spectrum, which is to evaluate.

Example: C:\EDWIN\SPEKTREN\EXAM.IMP evaluation of spectrum EXAM.IMP

'Wildcards' are permitted:

Example: C:\EDWIN\SPEKTREN\EXAM*.IMP evaluation of all spectra in current directory
EXAM.IMP
EXAM1.IMP
EXAM_A.IMP
.....

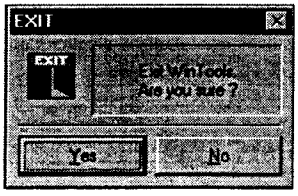
So with function **Point**, operator is able to evaluate a stock of spectra with gaps in spectra name number series (in contrast to function **Spect**).

In most cases, communication of other programs with WinTools Point function is not synchronized. The time for spectra acquisition must be longer than the automatic spectra evaluation program needs to finish his job, in worst case. Otherwise WinTools never get information via remote control file of any ready measured and stored spectra during the evaluation of last spectrum. If the program is finish, it will get the order for the next spectrum. But the next is the last from WinShell stored, possibly one ore more evaluations are lost.

A interesting combination is possible with **WinShell** or **SpcView**. If **WinTools** is open and function **Point** started, **WinTools** spectra window can be switched into Windows background. Each spectra storing with **WinShell** or **SpcView** and each spectra loading with **SpcView** cause the quantitative evaluation of current spectrum automatically (in background). Taking into account special quantitative settings for automatic evaluation, described above, operations only with **WinShell** or **SpcView** are possible. You can work very comfortable e.g. with online quantification in background operation using both programs **WinShell** and **SpcView** only.

3.8. Exit from WinTools

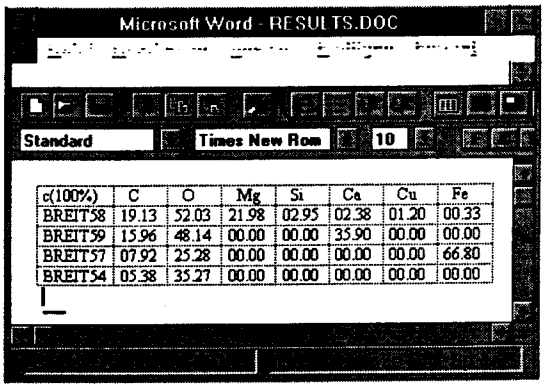
To exit from WinTools, use the appropriate icons or other methods that are normal under WINDOWS. For security, you are always asked to answer a question.



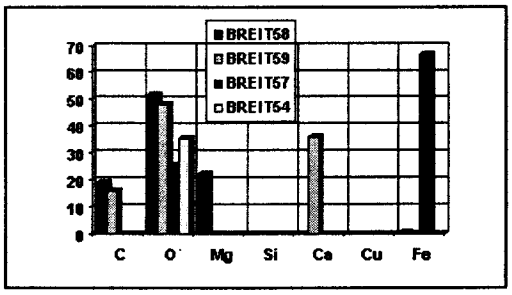
However, the final closing of WinTools only occurs when any open dialogs with the program have been satisfied. All windows belonging to WinTools are closed!

4. Spreadsheet, graphic presentation of results

Often, a whole series of analysis results must be archived, processed or presented. For this purpose, the printer switch of the WinTools program should be set to Result output in table form (cf. section 3.3.4.). The printing is diverted to a window. The measuring results can then, for example, be processed statistically in a spreadsheet program or presented in a graphic presentation.



c(100%)	C	O	Mg	Si	Ca	Cu	Fe
BREIT58	19.13	52.03	21.98	02.95	02.38	01.20	00.33
BREIT59	15.96	48.14	00.00	00.00	35.90	00.00	00.00
BREIT57	07.92	25.28	00.00	00.00	00.00	00.00	66.80
BREIT54	05.38	35.27	00.00	00.00	00.00	00.00	00.00

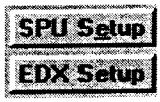


In the example, the results (see 3.3.4.) of WinTools were inserted in the "Word for WINDOWS" word processor to be further processed as a table. It should be pointed out here that these possibilities of further processing the data are not part of the standard scope of delivery of EDWIN and depend largely on the capabilities of the non- RÖNTEC programs used.

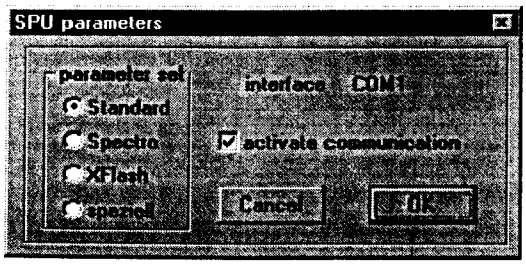
5. Settings of the interface, the detector parameters, the calibration and the pulse electronics type

The entry of all parameters of the driver for the MCA processor is carried out with **Settings** and **MCA settings**. Here, the address of the MCA processor card pre-set at the factory is entered. The selected interface between the PC and the SPU (signal processing unit) must be entered. Care must be taken that the cable is connected to the correct serial interface of the PC (note the PC operating manual!), as no PC-controlled setting of the pulse processor is otherwise possible (warnings after program start!).

The functions **SPU Setup** and **EDX Setup** are required to enter the calibration, the detector parameters and the configuration of the pulse electronics:



The type of the SPU is selected under **parameter set** (different shaping time, pulse throughput, degree of conversion, channel width in eV and spectrum end in keV, pulse density of zero peak in pulses/sec).



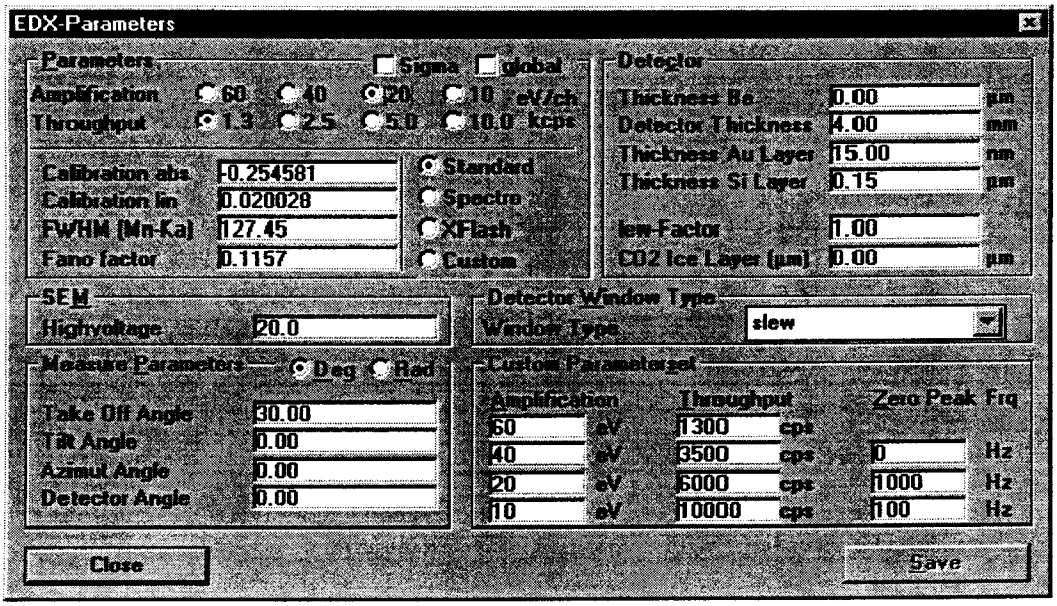
The parameters of some types of SPU can be set and monitored by the WinShell program. If this possibility does not exist or if the setting is done directly on the SPU with hardware switches, communication between the software and the SPU must be prevented.

If there is not to be any communication with the SPU (selection of setting on the SPU by switch), Signal processing unit (**activate communication**) must be deactivated.

The communication of the PC with the SPU requires that the SPU must already be switched on before the PC is switched on. If it does not work, switch off both devices and switch on again in the order: 1. SPU, 2. PC.
Depending on the PC, it may be necessary to switch off for several minutes (voltage supply of the MCA is sometimes provided for a long time even after it is switched off).

Under **EDX Setup** (see illustration) the parameters are set for the

- Detector parameters **Detector**
- Measuring conditions geometry / E_O **SEM / Measure Parameters**
- Resolution of the detector **FWHM / Fano factor**
  (dependent on the selected pulse throughput)
- Energy channel calibration **Calibration abs / lin**
  (dependent on the selected energy range of the spectrum)



With the entries in this menu, the driver for the MCA processor, and thus the file 'dspdrv.ini', is directly altered. If incorrect entries are made, it is possible that the system cannot be operated! If After the installation of the system it is therefore sensible to save 'dspdrv.ini' both on the original disks and in a backup directory.
Restarting the computer does not solve the problem, the "faulty" file 'dspdrv.ini' must be overwritten by the original file from the disk.

APPENDIX

Switching the X-ray spectrometer (hardware) on and off:

UHV-Dewar Detector and other Si(Li) detection units

Starting work:

1. **Switch on the detector power supply and the mains switch for the SPU**
   Green lamp "DS" lights up
   Green lamp on switch lights up

2. **Switch on the device computer**
   Control lamp lights up

3. **Switch on the monitor**
   Control lamp lights up

4. **Switch on the periphery (if required)**
   Control lamp lights up

After about 1 minute, a constant beep sound comes from the SPU. When this beep tone goes off after about 1 minute, the detector is ready to operate. You can then begin spectrum measurement.

End of work:

1. **Save all results from the work**

2. **Exit from WinShell and WinTools and/or close down the system directly from the desktop**
   (See instructions for WINDOWS®)

3. **You can switch off**
   the device computer
   the monitor
   the mains voltage supply to the SPU and
   the high voltage supply to the SPU (on the rear)

The SPU can remain switched on. When it is switched on, the software system must be closed down before switching off.

We recommend switching off the appliance at the end of the working day and switching it on again at the beginning of the next day. After it has been switched on, it takes about 15 minutes before the electronics have reached a thermal balance. Test measurements can, of course, be carried out beforehand.

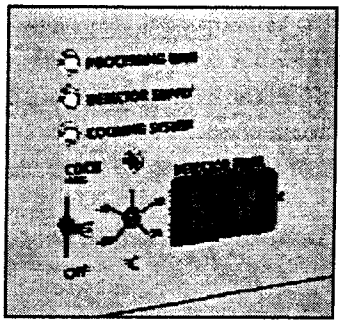
For the use of the **RONTEC UHV Dewar** detector, please read the hardware description!

RONTEC XFlash Detector

Starting work:

1. Switch on the SPU-unit or switch off Standby switch

Lamps "PROCESSOR UNIT" and 'DETECTOR SUPPLY' lights up
Lamp "COOLING SYSTEM" lights up
Lamp "COOL max." lights up



2. Switch on the dvice computer

Control lamp lights up

3. Switch on the monitor

Control lamp lights up

4. Switch on the periphery (if required)

Control lamp lights up

Normally the thermoelectric cooler is set to thermostat operation (switch in middle position). When the preselected temperature has been reached the "COOL max." lamp goes off. A value is shown in the temperature display which has to correspond to the preselected thermostat temperature. The system is ready to operate in a few seconds. A warm-up time of 1 ... 2 hours should be allowed for measurements that place high demands on the energy calibration.

If owing to environmental conditions the thermostat temperature is not reached at system start-up, or if the "COOL max." lamp lights up during measurements (temperature no longer maintained), the environmental conditions must be improved or a higher thermostat temperature must be selected at which stable operation is possible.

Fluctuating detector temperatures cause the channel energy calibration to change constantly!

End of work:

1. **Save all results from the work**

2. **Exit from WinShell and WinTools and/or close down the system directly from the desktop**
   (See instructions for WINDOWS™)

3. **You ca switch off**
   the device computer
   the monitor
   the mains voltage supply to the SPU or switch on Standby switch

It is recommended that the detector be kept constantly operational to preclude minor parameter changes each time it is switched on and to avoid long-term drift. In **standby** mode the supply voltages for the detector (with the exception of the thermoelectric cooler) are maintained. No warm-up effect occurs.

For the use of the **RONTEC XFlash** detector, please read the hardware description!

Setting up the measurement conditions:

Beam current

The intensity of the X-ray radiation is directly affected by the beam current which acts on the sample. In most SEMs, the control of the beam current is carried out by adjusting the emission from the cathode and adjusting the condenser. The operation manual of the SEM should be consulted in this respect. The intensity of the X-ray radiation received by the detector is measured. For this purpose, the text *cps:...* (counts per seconds) is displays in WinShell in the lower left hand corner. The dead time (*dead: ....%*) should not significantly exceed 50%.

Sample and sample geometry

The sample for analysis must be suitable for examination in a scanning electron microscope (SEM). That means that the surface must be conductive and, from an idealised perspective, level.
The geometric conditions in the SEM are shown in the image of geometric conditions of electron beam micro-analysis.

The **working distance** is the distance from the lower edge of the pole piece of the SEM objective to the surface of the sample. Because of the geometric conditions, this value is prescribed as a fixed value, and the sample must be brought into this position when it is fixed to the mount and/or by moving the Z axis. The working distance of a sample with the standard sample mount is defined when the system is installed.

The **take off angle** is the angle between the longitudinal axis of the detector and the horizontal. This value is entered as a fixed value in the excitation conditions and does not normally need to be changed. Value can be changed (see section 5).

The **tilt angle** is the angle between the surface of the sample and the horizontal. The sample can be tilted in order to reduce the absorption of the X-rays on their way from their point of origin in the sample to the surface facing the detector.

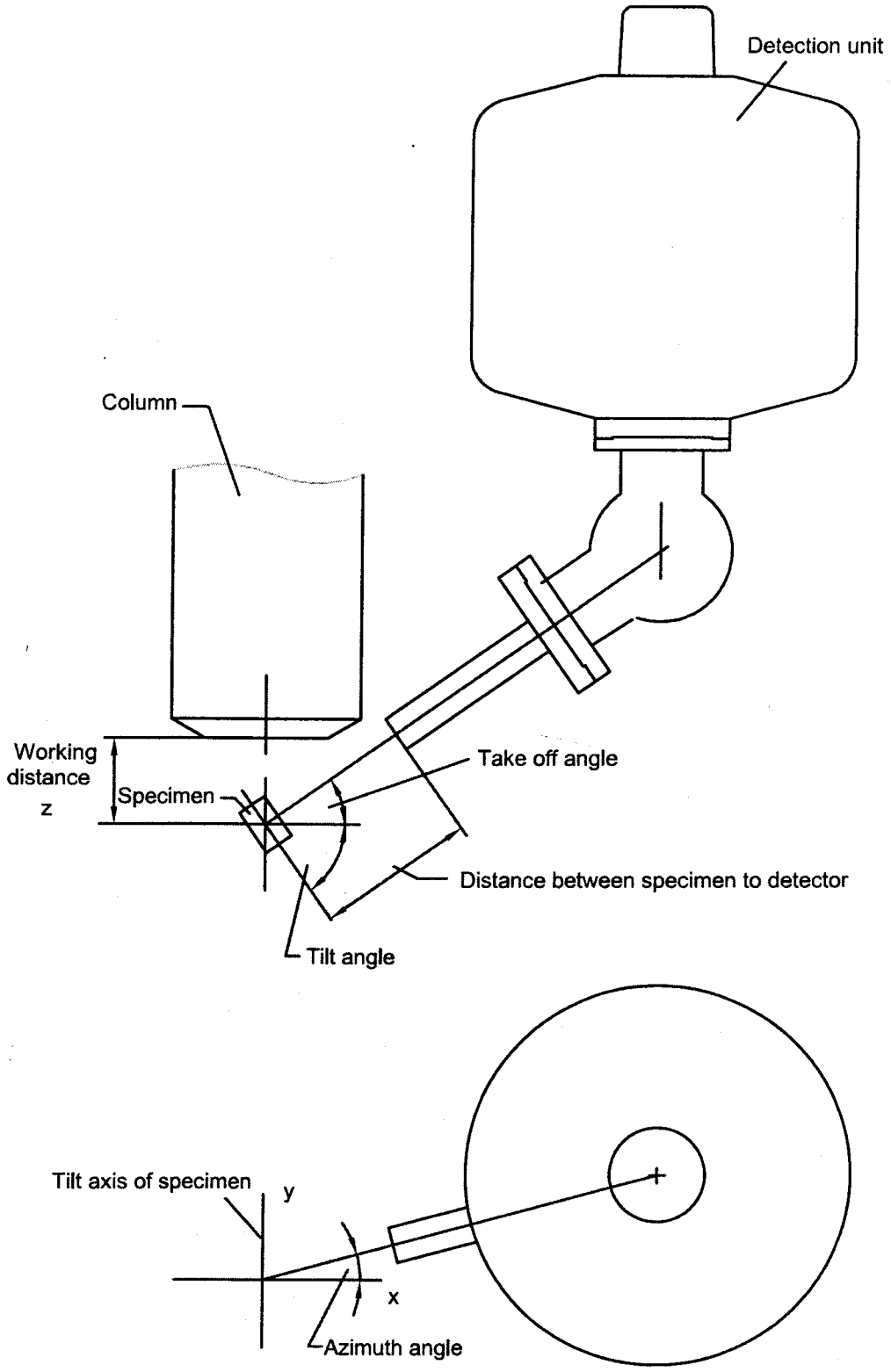
The standard tilt angle entered is generally 0 degrees. When measuring with a tilted sample, the value of the tilt angle must be entered (see section 2.2.).

The **azimuth angle**, when regarded towards the electron beam, is the angle between the longitudinal angle of the detector projected into the plane and the vertical angle to the tilt axis of the sample. This value is prescribed as a fixed angle in the installation of the detector in the SEM. The value entered can be made (see section 5).

The **detector angle** is the angle between the vertical of the detector angle and the axis of the detector finger. This value is also entered as a fixed angle and can be changed (see section 5).

The **distance between the detector and the sample** can be changed by turning the hand wheel on the support. If the distance is reduced, this widens the solid angle of the X-ray radiation from the sample that is measured by the detector. This increases the pulse density. Conversely, the pulse density can be reduced by moving the detector further from the sample.

At the minimum distance from the detector to the sample, care must be taken to ensure that there is no collision with the detector finger if the sample table is moved.



Geometric conditions in electron beam microanalysis

X-Y adjustment

The sample can be moved with the X-Y adjustment of the sample table. It must be noted that it is only possible to use a tilt at the same time if the movement of the sample table is eucentric, i.e. if the X-Y movement of the sample takes place in the tilt plane, and thus the working distance for microanalysis remains constant.

Adjustments in EDWIN (WinShell):

with UHV-Dewar Detector or other Si(Li) detection units

The task in the measurement of a spectrum is to obtain a spectrum with sufficient statistics (number of measured events in the spectrum) and the best possible resolution of the characteristic lines in the smallest possible measuring time. As these requirements contradict each other, the operator must select a compromise for each specific task (cf. also the hardware description). In **Settings** and **SPU settings**, the setting Pulse Throughput must be changed. The numerical examples refer to a RÖNTEC UHV Dewar Detector and have to be modified or are permanently set when a RÖNTEC XFlash detector or other detectors are used:

Case I: **Precise spot analysis**
The aim is the best possible resolution, the measuring time is of secondary importance.

Suggested setting:	Pulse throughput	1.3 kcps
	Pulse density:	appr. 2000 cps
	Measuring time:	300 sec.

The accumulated spectrum then consists of about 500,000 events.
After evaluation, also note the value given for the error of the event.

Case II: **Fast analysis with reduced precision**
The aim is the optimisation of the measuring time in serial measurements.

Suggested setting:	Pulse throughput	6 kcps
	Pulse density:	appr. 10,000 cps
	Measuring time:	50 sec.

The accumulated spectrum then consists of about 250,000 events.

Case III: **Fast analysis time critical**

The aim is the lowest possible measuring time per measuring spot, high quality resolution can be dispensed with.

Suggested setting:	Pulse throughput	10 kcps
	Pulse density:	appr. 24,000 cps
	Measuring time:	1 sec.

The accumulated spectrum then consists of about 10,000 events.

with XFlash detector

The XFlash detector generally has a high pulse tolerance. The differences in energy resolutions for different forming times are slight. For that reason, only two main amplifier modes are offered. Owing to limitations in the ADC and in the MCA processor card, not more than 40 kcps can be saved. The values given under pulse throughput for the XFlash therefore refer to optimum input pulse rates.

The pulse throughput can be set in **Parameter / SPU Parameter.**

Alternatively, the pulse throughput can be set to 20 kcps. The detector achieves its best energy resolution at that setting for 1000 cps, although unlike a Si(Li) it is only a few eV better than in normal mode (80 kcps). Owing to the much greater pulse dynamic, therefore, the 80 kcps setting is preferable.

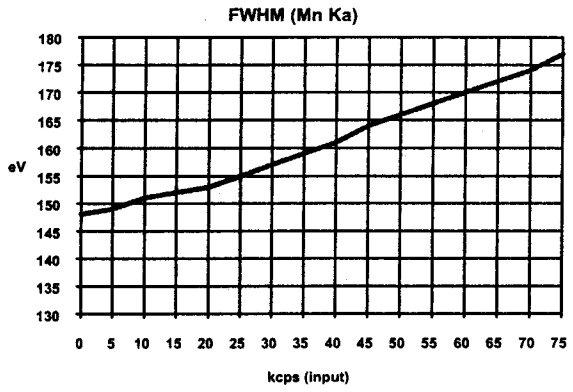
Case I: **Quick analysis of reduced precision, qualitative and for Scan/Mapping via pulse outlets**

Proposed basic setting:	Pulse throughput	80 kcps
	Pulse density:	80 000 cps and more
		about 40 000 cps are saved
	Measuring time:	1..10 s

The accumulated spectrum then consists of about 40 000 to 400 000 events.

Since in the case of the XFlash, unlike the Si(Li) detector, the half-life width increases with the number of pulses, a reduction in the pulse density is recommended for good energy resolution with problematic spectra. The signal electronics selector switch setting need not be changed.

Good energy resolution is required when superimposed lines need to be unfolded or elements in a concentration near the limit of detection are of particular interest.



Case II: **Precise point analyses**

The goal is good resolution, the measuring time is of secondary importance.

Proposed basic setting:	Pulse throughput	80 kcps or
		20 kcps (best possible resolution)
	Pulse density:	about 2000 cps
		about 2000 cps are saved
	Measuring time:	200 s

The accumulated spectrum then consists of about 400 000 events.
Note also the result error indicated after the evaluation.

If the pulse density exceeds the permissible value, dependent on the hardware setting, the dead time rises significantly above 50%. The pulse density must be reduced or a hardware setting with a higher pulse compatibility must be selected. Then, spectrum accumulation must be restarted.

At more than 50% dead time (percentage adjustable in winshell.ini) WinShell switches over to red dead time and pulse density indication. If the admissible dead time is substantially exceeded an error window is displayed.

DDE-Control:

Interface to control **WinShell** with DDE with exterrnal programs (option):

```
*****************************************************
Description of High-Level-Roentec DDE interface
*****************************************************

DDE-ServerName:      'SPC_SERVER'
DDE-TopicName:       'SPC_MEASURE'

DDE-ItemNames:              function                    data format    Requ. Adv. Poke
-------------------------------------------------------------------------------------

'SPC_GET_STATUS'     : read status                                      R   A
        result   =0  manually stopped
                 =1  automatic stop
                 =3  running
                 =5  paused

'SPC_MSTART'         : start manually                                   P

'SPC_RSTART'         : start with real time setting     longint, second P

'SPC_LSTART'         : start with life time setting longint, second     P

'SPC_WSTART'         : start with counts setting                        P
        CountWinRecord = record
                first, last: integer(2 byte)
                counts     : LongInt(4 byte)
        end;

'SPC_STOP'           : stop                                             P

'SPC_GET_COUNTRATE': read pulse density     longint, cps          R  A

'SPC_GET_DEADTIME'       : read dead time       longint, second   R  A

'SPC_GET_RTIME'          : read real time       longint, second   R  A

'SPC_GET_LTIME'          : read life time       longint, percent  R  A

'SPC_GET_SPECTRUM'       : read spectrum data array
                         spectrum=array[0..number of channels]
                         spectrum[0]=number of channels

'SPC_GET_ALT_SPECTRUM'   : read spectrum data   string             R  A
                         ##nr;1.ch,;2.ch;....;last channel;##
```

'SPC_SAVE_SPECTRA' : save spectrum with header string, file name P

'SPC_GET_WINDOWLIST' : read all measure windows (ROI) R
array[0..30]of integer
[nr,1.start,1.end,2.start,.....,last start,last end]
if window is not in use, start=-1, end=-1

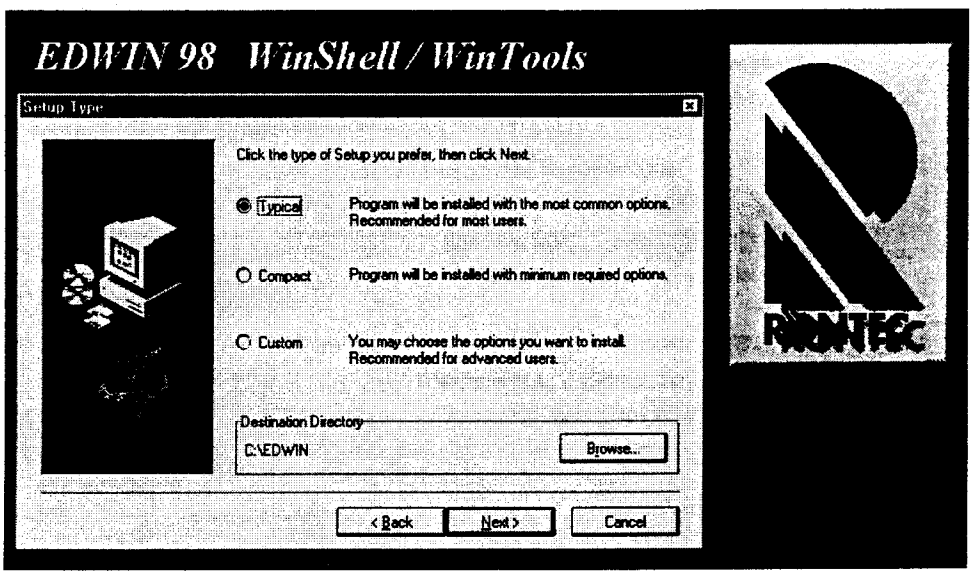
'SPC_GET_ALT_WINDOWLIST' : read all measure windows (ROI) R
##nr;1.wnd,;2.wnd;....;last wnd;##
if window is not in use, start=-1, end=-1

'SPC_GET_WINCOUNTS' : read counts in all measure windows (ROI) R
array[0..15]of LongInt
[nr,1.wnd,2.wnd,.....,last window]
if window is not in use, count=-1

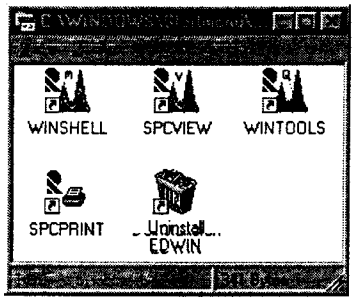
'SPC_GET_ALT_WINCOUNTS' : read counts in all measure windows (ROI) R
##nr;1.wnd,;2.wnd;....;last wnd;##
if window is not in use, count=-1

Installation of EDWIN software (WinShell and WinTools):

EDWIN is delivered on several floppy disks. The installation program setup.exe is on Disk 1. The program is started from WINDOWS (**A:\setup.exe**), and the user is guided through all other necessary information and input steps:

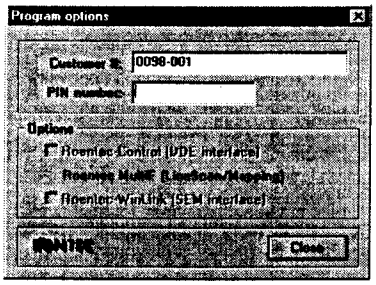

EDWIN 98 WinShell / WinTools
Setup Type
Click the type of Setup you prefer, then click Next.
Typical
Program will be installed with the most common options. Recommended for most users.
Compact
Program will be installed with minimum required options.
Custom
You may choose the options you want to install. Recommended for advanced users.
Destination Directory
C:\EDWIN
Browse...
< Back
Next >
Cancel
RÖNTEC

The installation sets up new objects in WINDOWS. **WinShell** and **WinTools** are the two main EDWIN programs.



Uninstall EDWIN is used to uninstall EDWIN. All the files, icons and links are removed. The files generated during the operation of the programs (such as spectra, results, parameter files, automatic routines) are not deleted. The **dspdrv.ini** file is also generated during program operation. Thus reinstallation of the program system does not overwrite the parameters and the calibration of the detector.

From WinShell Version 1.3 up to higher versions, **dspdrv.ini** is located in WINSHELL directory! Making update of older version, please take into account, that it is necessary to copy the old **dspdrv.ini** from the old used WINDOWS directory into the new WinShell directory! Otherwise you will loose all individual detector data and calibrations.



After installation operator has to set options:

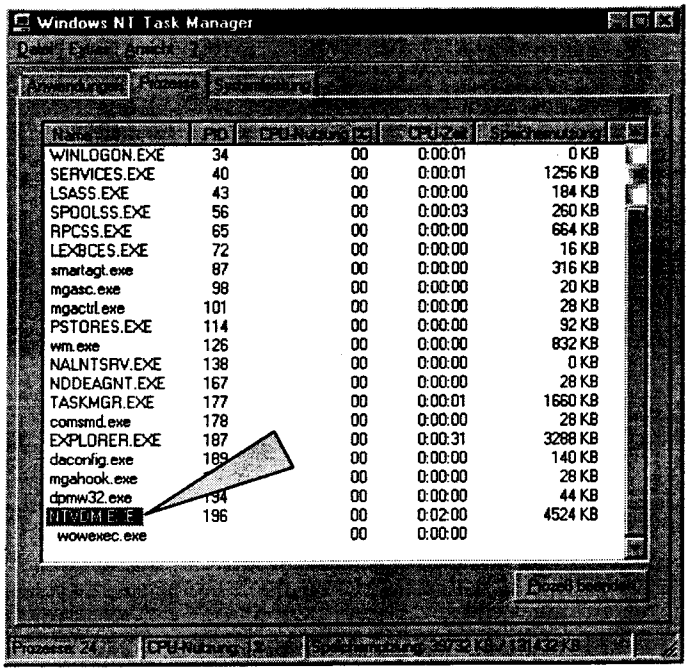
RÖNTEC-MultiE (TTL pulses for mapping)
RÖNTEC-Control (DDE control of WinShell)
RÖNTEC-WinLink (parameter transfer from REM)

It is possible to set customer# and PIN code (includes purchased options) via **Extra / Program Options**. Both information are on original disks or are given otherwise.

Error management of EDWIN software (EDWIN NT for Windows NT 4.0):

Windows NT™ is a powerful multitask operating system. Therfore you should not restart the computer in cases where the EDWIN components do not working well (after crashs of other software or of WinShell or WinTools itselfs). Please confirm with the following steps:

1. Open the task manager of Windows NT.
2. Kill th proces NTVDM.EXE.
3. Start EDWIN parts (WinShell / WinTools) once again.


Windows NT Task Manager
WINLOGON.EXE 34 00 0:00:01 0 KB
SERVICES.EXE 40 00 0:00:01 1256 KB
LSASS.EXE 43 00 0:00:00 184 KB
SPOOLSS.EXE 56 00 0:00:03 260 KB
RPCSS.EXE 65 00 0:00:00 664 KB
LEXBCES.EXE 72 00 0:00:00 16 KB
smartagt.exe 87 00 0:00:00 316 KB
mgasc.exe 98 00 0:00:00 20 KB
mgactrl.exe 101 00 0:00:00 28 KB
PSTORES.EXE 114 00 0:00:00 92 KB
wm.exe 126 00 0:00:00 832 KB
NALNTSRV.EXE 138 00 0:00:00 0 KB
NDDEAGNT.EXE 167 00 0:00:00 28 KB
TASKMGR.EXE 177 00 0:00:01 1660 KB
comsmd.exe 178 00 0:00:00 28 KB
EXPLORER.EXE 187 00 0:00:31 3288 KB
daconfig.exe 189 00 0:00:00 140 KB
mgahook.exe 00 0:00:00 28 KB
dpmw32.exe 194 00 0:00:00 44 KB
NTVDM.EXE 196 00 0:02:00 4524 KB
wowexec.exe 00 0:00:00

German example

Some user hints for X-ray spectrometer systems with Windows NT:

You have got a **X-ray spectrometer**, which uses PC system with **Windows NT™** for data acquisition and data evaluation. Configuration of PC and operating system are done in a kind, which guarantees optimal performance for running analytical tasks.

Please confirm the following hints:

- **User status**

The safety mechanism of **Windows-NT** are managed via user groups. For X-ray analysis, **user**- or **main user**-state will do it. User **edx** with password **edx** is installed for each RÖNTEC spectrometer. Password can be changed. Additional user with other passwords are possible to install.

- **Administrator**

In delivering case, the **administrator** has password **test**. If you are going on line with RÖNTEC spectrometer into your own network, password shoud be changed by system administrator .
The special defined user **service** with administrator rights is only useful for RÖNTEC service staff. Please, do not change it!

Customer should never run the RÖNTEC spectrometer (the analytical performance) with administrator status rights! After working with administrator rights, start the computer again.

- **Passwords**

Primary following user are installed:

user	password	status	remarks
administrator	test	administrator	password can be changed
service	*******	administrator	password change is forbidden
edx	edx	user	password can be changed

- **Computer network**

You can insert the RÖNTEC spectrometer in common networks. Do not try to install the RÖNTEC spectrometer like a server. Please use the performance of net server for data exchange.

•

Do not change the ***BIOS***. Do not install ***screen safer*** and ***sound boards*** (even in such case, where the sound card is a part of your computer or sound card is on board):

- Sound board

X-ray spectrometer do not need a **sound card**. Active sound card influences quality an efficiency of image scan, line scan and mapping.

- BIOS

Do not use **power managment** (sleeping mode after predefined time without any operating).

- Screen

Do not use **screen safer**. Please run display with colour depth of **32 Bit** or **24 Bit**. Use 19" display with 1280 x 1024 pixel with 85 Hz. Do not change installed mode!

Installation of EDWIN software (EDWIN NT for Windows NT 4.0):

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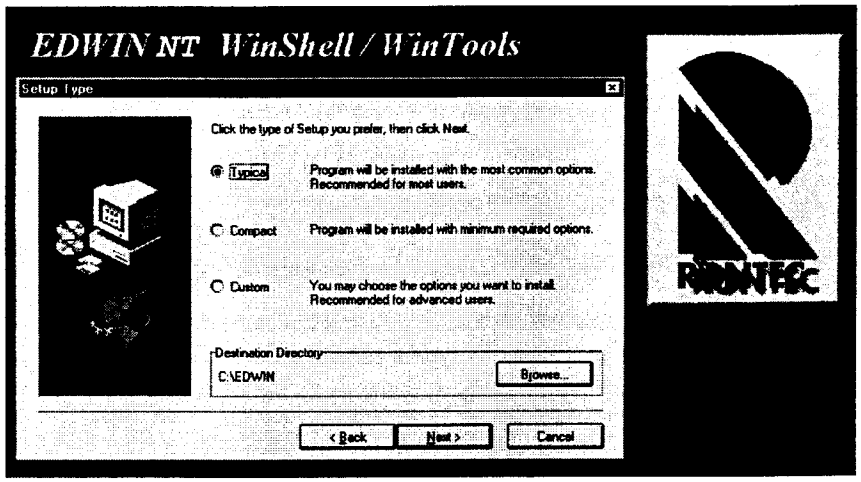
EDWIN NT WinShell / WinTools
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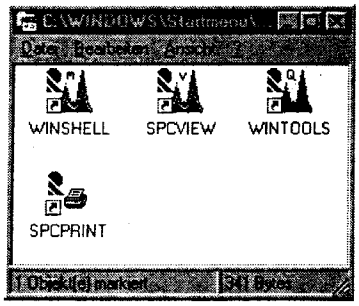
Browse...
< Back
Next >
Cancel
RÖNTEC



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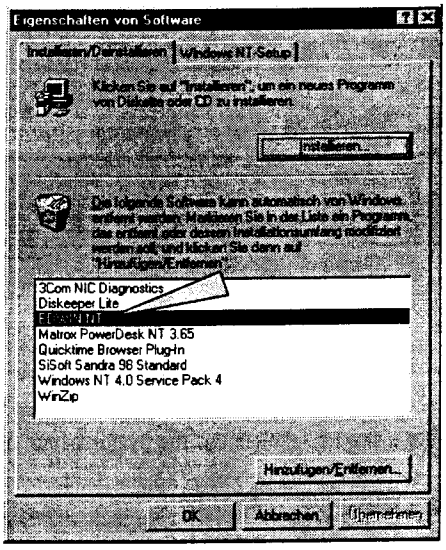
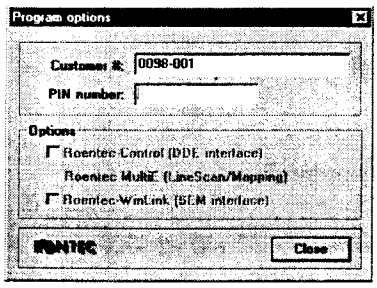


German example

Common used 32 bit Windows uninstallation is used to uninstall EDWIN, too. All the files, icons and links are removed. The files generated during the operation of the programs (such as spectra, results, parameter files, automatic routines) are not deleted. The **dspdrv.ini** file is also generated during program operation. Thus reinstallation of the program system does not overwrite the parameters and the calibration of the detector.



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